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Government Attitude Toward Business

OUR MOST serious national problem at the present time is the vast number of unemployed people who are physically and mentally capable of earning their own living, but due to the depressed condition of business, are unable to find employment. Various estimates place the number of unemployed from 10 to 12 million. It is highly significant that a great deal of the blame for the present deplorable unemployment situation has been placed on the Federal government, or directed specifically at the New Deal administration now piloting our national government. It is not difficult to see why prominent industrialists place most of the responsibility for our huge unemployment problem on the government. In every case men prominent in the business world point to the antagonistic attitude toward business as expressed by political leaders high in the councils of the New Deal, including even the President.

We noticed recently in an issue of the "Daily Metal Trade," published in Cleveland, Ohio, an article under the heading "Government Must Reverse Attitude Toward Industry if Idle Are to Be Re-employed." We found that this statement, written by James F. Lincoln, well known in the welding industry, set forth the attitude of business leaders in rather forceful but clearly expressed language. Believing that Mr. Lincoln's analysis of our present economic situation is thoroughly sound and of vital importance to practically everyone in the welding industry, we take the liberty of quoting from Mr. Lincoln's statement. Activity in welding is rather intimately related to the degree of activity in the heavy industries which manufacture capital goods. The present recession in business has been particularly felt in the heavy industries which make extensive use of welding as an assembly tool.

Here is what Mr. Lincoln believes to be wrong in our present situation:

"There are altogether too few industrialists now to employ all who wish to work in industry, yet the job of the industrialist is being made so difficult by government that many previously successful industrialists cannot succeed now. Worse than that, we are discouraging the man who can and would try to start an industry if let alone . . .

"We must accept the fact that industrial employment and industrial production is not made by government but by the individual. All the comforts of life are not the result of governmental action (rather the reverse), but of the rare genius with an idea and with the moral, mental and physical attributes to put it through . . .

"The cheap automobile was made by Ford, not by government. All government has done is to increase the cost by about 35 per cent and to increase the cost of gasoline and oil by 250 per cent over what individual initiative would charge . . .

"If we want the advantages of industry we must allow it to have the tools of the trade, one of which is money. Why should we resent the profit of industry, often nothing when it produces our standard of living? We accept with little question the extraction of an amount which is five times as great from our pocketbooks by government, much of which is now wasted.

"At the present time the number of people who can be employed in industry is decreasing. During the last six years more than $20,000,000,000 has gone out of industry into other fields or into banks. That means fewer jobs. The damage already done by governmental interference is to a large extent permament and this generation cannot recover all the ground lost. The best they can do is turn retreat into advance . . .

"We have not yet met our crisis. That will come when we find that our governmental income, which is decreasing yearly, cannot be brought up to our governmental expenditure for relief, pump priming and other political expedients. When that time comes our crisis will be on us. Dictatorship or freedom will be the answer. We cannot escape treading the road back. We can only determine whether we will do it as convicts or as free men. We will then decide whether government is made for man or man for government."

360 of these trash racks were built for Grand Coulee Dam by Arthur J. O'Leary & Sons Co., Chicago, Ill. Racks are approx. 12' x 10', weigh 4300 lbs. and contain 260 fillet welds. Tolerances are plus or minus ⅛" in width or length and within ⅜" of a true plane. Welded by Lincoln "Shield-Arc AC" Welders and "Fleetweld 8" Electrode with a Lincoln man assisting in the application.

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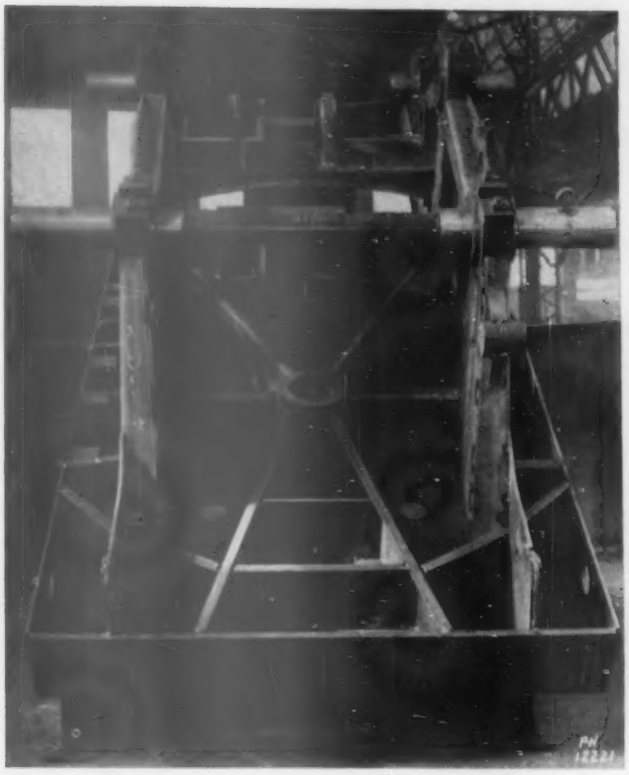


Huge excavator frame ready for welding after being tack-welded on assembly jig. (This is Fig. 11 in the author's series of keyed captions.)

Production economies obtained by use of

Welding Jigs and Fixtures

★ A good welding jig must have movable parts protected from intense welding heat. Copper splatter protection plates used

BY E. C. BRECKELBAUM

Welding Foreman, Harnischfeger Corp., Milwaukee, Wis.

JIGS AND FIXTURES have been used for years to aid in the making of all sorts of machined parts. Probably everyone has seen or heard about the elaborate jigs and fixtures that are used in the machining and assembling in the automobile and other mass production industries. Today, most of these jigs are made of welded construction, and welding has made many jigs possible which could not be manufactured before, and it has appreciably reduced the cost of many others.

This article is not going to deal with these machining or assembling jigs, but with jigs or fixtures that are used in assembling and welding of welded products. There are some general facts and precautions which have to be considered in making jigs for welding, which do not apply to machining jigs. First of all, the factor of heat enters in. In order to have a welding jig work satisfactorily, the moving parts have to be protected from the heat of the arc and the splatter of welding. The use of copper splatter protection

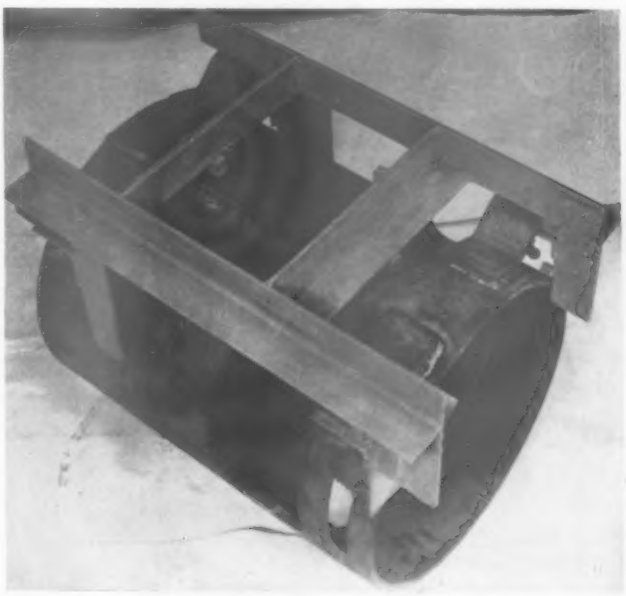


Fig. 1—A shop-made jig to assemble the feet onto a welding generator frame. A simple angle iron frame which straddles the rolled generator ring.

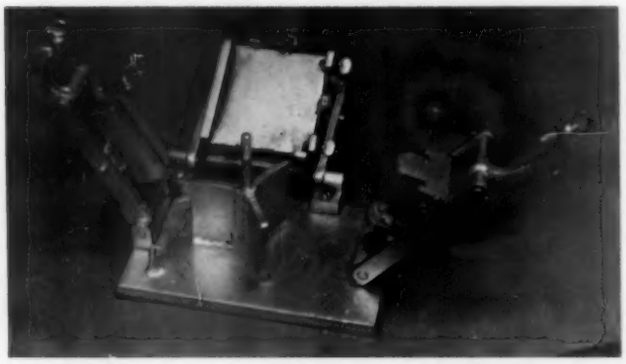


Fig. 2—Jig designed for assembling a small welded jib-lift hoist frame.

plates helps a great deal in protecting the sensitive parts of the jig and in the removal of the weld splatter from the jig pads. Because of the heat warpage, all the movable joints have to be made with looser fits, and often it is hard to convince the jig makers or designers of this fact, especially those who are used to making jigs for the machine shop. Considerable detailed thought has to be given to the shrinkage and warpage of the steel parts owing to the welding or tacking heat, so that there is no chance for the pieces to bind in the jig after they are welded or tacked together.

Two Classes of Welding Jigs

Welding jigs may be divided into two classes: those that are made by the welder or set-up man right in the welding shop, and those machined jigs which are designed by the tool or jig designer and are made in the toolroom or machine shop.

Rough welding jigs that are made by the welder or set-up man out of scrap plate and structural shapes are probably familiar to most of us. They have been used for many years in most welding shops. These jigs are very economical to make, since most of the material is taken from scrap and only a few hours of the welder or set-up man's time are needed to put them together. The ideas for these jigs usually come from the men working directly on the job, or from their immediate supervisors, because they see their need and application.

In the modern welding shop many of these jigs are made; we make as many as five of these every week. They range from a simple welded bracket to help square up a job to rather complicated fixtures. Most of the time there is no machining on these jigs. The best way to make up these jigs is to build up the piece to be made, check it, and then build the jig around that piece. Figure 1 shows one of these

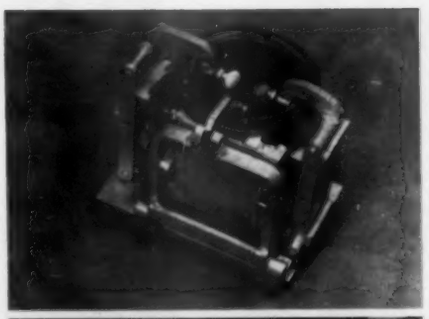


Fig. 3 — (Bottom) Hoist frame jig with pieces in place on the jig ready for clamps as in Fig. 4.

Fig. 4—(Top) Frame ready for tack-welding in the jig.

shop-made jigs. It is used to assemble the feet, made out of bent bar stock, onto a welding generator frame, which is a rolled ring. The jig is an angle iron frame, which straddles the generator ring like a saddle. Feelers on the end of the ring and in the square cut-outs give the proper location for the feet. The feet are clamped to the frame by thumb screws. After tacking and welding, the screws are loosened and the jig frame is slipped off from one end.

A Skilled Jig Designer

For complicated pieces and for pieces of which a large number is to be made, it is usually advisable to give a little more thought to the jig, and it pays to make a drawing or sketch, so that the jig can be properly made in the tool room or machine shop. These jigs often cost several hundred dollars, but we have found that they soon pay for themselves. Figures 2, 3 and 4 show one of these machined jigs which is used for assembling a small welded jib-lift hoist frame. The cost of assembling this unit with this jig is only one-fifth of what it was without the jig. In addition, the frames are made more uniform and to closer tolerance, which has also decreased the finish allowance and machining cost. Figure 2 shows the jig in the open position. Figure 3 shows the separate pieces in place on the jig, and Fig. 4 shows the frame ready for tacking in the jig. I think this jig gives a good idea of the scope and possibilities of small jigs for welded parts.

A More Complicated Example

Figures 5, 6, 7 and 8 show jigs used in the assembly of electric motor frames. These frames are of a very light construction, but are very rigid after being completely welded. They are very difficult to assemble, because they have no rigidity until completely assembled. Frames also have many finished surfaces, and only one-eighth of an inch finish is allowed for machining. Without the jig no uniform product could be made, and the machining tolerance could not be constantly held. With the jigs, the frames are very uniform and they can be assembled in one-sixth of the time. The machining is also very economical due to the small allowance necessary.

The frame is made of four channels, two flat rings, and an angle iron ring. The channels are sub-assembled as in

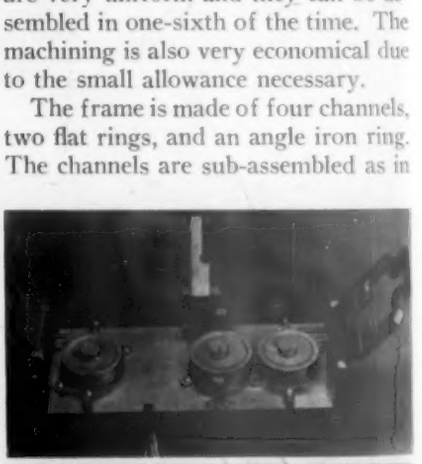


Fig. 5—(Top) Motor frame jig in open position.

Fig. 6—(Bottom) Channel assembly of small motor frame in place in the welding jig.

Fig. 7—(Bottom) Final assembly jig for small motor frames. Center screw regulates 8 equalizing pins to bring channels in proper alignment.

Fig. 8—(Top) Motor frame in the jig after tacking.

Fig. 5 and Fig. 6. In Fig. 5 the jig is shown in the open position. The locating hinges for the finish pads and angles are made of brass to prevent the weld splatter from adhering, and also, so that they will not be affected by the magnetism. The jig holds the pieces, after location of the hinges, by magnetic force to the channel. The three magnet coils can be seen in Fig. 5. The channel assembly in place in the jig is shown in Fig. 6.

I have never seen a magnetic jig used in any other similar operation. It is very fast, and where many pieces are to be assembled, it is economical. The only disadvantage is that the magnetism interferes a little with the arc when tacking in the fixture. The rings are assembled to the proper diameter in shop-made jigs not shown. The final assembly is made as in Figs. 7 and 8. Figure 7 shows the jig alone. By turning the center screw, the eight equalizing pins move out to centralize the four channels and press them against the bar and angle-iron rings. Figure 8 shows the motor frame in the jig after tacking ready for welding.

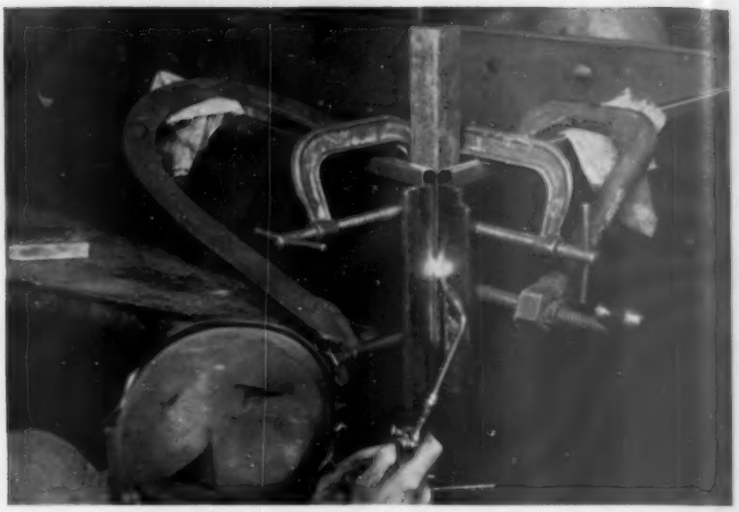
In the making of large machine pieces which have to be held to close machining tolerances, jigs become very necessary. A typical jig of this nature for positioning a large P & H excavator frame is shown in Fig. 9. In these large jigs, I have found it economical to use the large set-up or assembly tables as the base for the jig, and just locate and bolt the different jig parts onto the table.

In Fig. 9, the different jig sleeves for the bearings and locating brackets are shown bolted to the set-up table. In Fig. 10 the machine frame to be fabricated is shown located in the jig. The rigidity and accurateness of the jig, I think, is well brought out in this picture. Figure 11 shows the machine frame out of the jig, ready on the positioner for welding. The heavy pipe bearing locaters are left in the bearings to brace the side stands against warpage during welding. After the inside welding is done, the cover plates and some additional bracing are added. The feature of this design and manufacture is that all bearings and machined parts are located at the same time before any welding on the frame is done. This is a big advantage, because it is very nearly impossible to locate parts on a frame which is partially warped by welding, leaving no straight surfaces to locate from.

Fig. 10—Excavator frame located in the assembly jig ready for tacking.

Fig. 9—Jig sleeves for bearings and locating brackets are bolted to the set-up table.

The above examples give some idea of the possibilities of assembling jigs in the manufacture of welded parts. All these jigs help to make possible the most economical assembly of the parts. It pays dividends to realize that well-designed jigs make a uniform product possible — reduce the subsequent machining and assembling costs and allow closer working tolerances.



Oxy-acetylene welding of stainless steel sink—special clamping jig prevents warpage.

Best techniques to employ in

Stainless Steel Welding

★ Chrome-nickel types are most highly recommended for welding, because of toughness and ductility in the as-welded condition

By V. W. WHITMER

Welding Engineer, Republic Steel Corp., Cleveland Ohio

ONE OF THE MOST COMPLETE presentations of the subject of stainless steel welding is to be found in a recent booklet "The Welding of Enduro Stainless Steel." The contents of this booklet also formed the subject of a technical paper presented by V. W. Whitmer at the Atlantic City meeting of the A. W. S. In the author's opinion, chrome-nickel types of stainless are most highly recommended for welding, because of their toughness and ductility in the as-welded condition. The problem of carbide precipitation, when more than .08 per cent carbon is present, is explained and also its effect on corrosion resistance. Mr. Whitmer pointed out that suitable heat treatment will put this carbide back into solid solution, improving the corrosion-resistant properties. Stainless of the 18-8 variety has 60 per cent greater thermal expansion than mild steel. At the same time it possesses a lower heat conductivity. The increasing application of straight 18 per cent chromium for locomotive fire-box construction is mentioned as an application based on the low coefficient of expansion of the straight 18 per cent variety. Application of stainless to projection, seam and flash welding is also described. What follows is abstracted from Republic Steel Corporation's booklet on stainless steel:

As far as welding is concerned, practically the entire stainless steel field can be divided into two general classes: those containing only chromium as the alloying element, regardless of the amount; and the austenitic type, or those alloys containing both chromium and nickel in varying proportions.

The first class, ordinarily known as the straight chromium stainless steels, especially those containing 18% or more chromium, when heated to a high temperature are subject to a rapid grain growth and do not respond satisfactorily to heat treatment.

They can be softened to a certain extent provided proper control is followed in welding by annealing for eight hours or so at about 1450 deg. F. This may or may not be very satisfactory as much depends on the actual welding. As a rule numerous small beads will give the best results when followed by annealing.

Such alloys when welded possess very little ductility and therefore are not recommended where the product is subject to movement or shock at room temperature, as the welds are likely to crack on deformation or bending. However, if a little heat is applied or the operating temperature is about 200 deg. F. or more, the welds will be much tougher and at 400 or 500 deg. F. some bending will occur before breaking. Considerable thought should therefore be exercised before welding the straight chromium products.

Chrome-Nickel Group

The second class, or the chromium-nickel group, is most highly recommended for welding. These metals, being of an austenitic nature, are extremely tough and ductile in the as-welded condition. Where a straight chromium weld will probably snap as soon as bent, a chromium-nickel weld will bend back flat on itself with no sign of fracture.

These alloys, possessing properties as described above, can be satisfactorily welded as far as porosity or soundness is concerned by any commercial method in use today except forge or fire welding.

Arc welding an Enduro stainless steel sink at Tracy Mfg. Co., Pittsburgh, Pa.

The 18-8 has a high thermal expansion of about 60% more than that of common steel, a low heat conductivity of about 33 to 50% that of common steel, and a lower melting point, in addition to being very fluid in the molten state. These same characteristics apply to the straight chromium type, except that the coefficient of expansion is about 10% less than that of common steel. These factors should be taken into consideration in the design of any welded equipment in order to prevent difficulties which might arise from undue strains, warpage, etc.

Carbide Precipitation

While alloys of the chromium-nickel group make by far the most satisfactory welds from the standpoint of physical tests, they do under certain conditions exhibit a tendency toward "weld decay." When an 18-8 stainless steel with more than 0.08% carbon is heated between 1000 and 1500 deg. F., the excess carbon is precipitated or segregated out of solution and deposited along the grain boundaries in the form of carbides. These carbides are less resistant to corrosion than is the parent metal, with the result that wherever they are present, more rapid attack will occur when exposed to corrosive conditions.

In making a weld, the metal depositing and the joint itself are heated to the melting or fusing temperature, which is around 2690 deg. F., the body of the work remains cold. Hence, there will be a zone parallel to and near the weld which will be heated between 1000 and 1500 deg. F. and in which area carbides will be precipitated. This region may be wide or narrow, near or some distance from the weld, depending upon the type of joint and method of welding, which determines, of course, the total amount of heat applied. If welding is rapid, the zone will be narrow and close to the weld; if slow, it will be wide and further away.

Heat Treatment

This carbide can be put into solution again by heating to a temperature about 1900 deg. F. or higher and cooling fast through the critical range. Air cooling will be sufficiently rapid if the section is thin, 1/16-in. or less, but a water quench is advised if the apparatus is heavy.

If the material contains less than 0.08% carbon, such as Enduro 18-8-S, this carbide separation will be practically negligible, simply because there is not much carbon present and the small amount available remains in solid solution in the alloy itself. This carbide precipitation will not seriously affect the physical properties until it becomes quite extensive, but it will reduce the corrosion resistance considerably if present even in small quantities. For this reason, only 18-8-S is recommended for welded equipment which is to be subjected to highly corrosive attack and which cannot be conditioned after welding. It is also recommended for equipment operating at elevated temperatures, such as 1000 deg. F. or higher.

While reducing the carbon content to below 0.07% will practically eliminate precipitation of carbide during the short time of welding, it will not necessarily stop such condition in equipment operating continuously between 1000 to 1500 deg. F. Additions of such alloys as columbium, titanium, molybdenum, etc., to the low carbon product will still further reduce this tendency. Where heating alone is the factor, columbium or titanium is satisfactory. If corrosion-resistance is of most importance, then molybdenum is to be preferred.

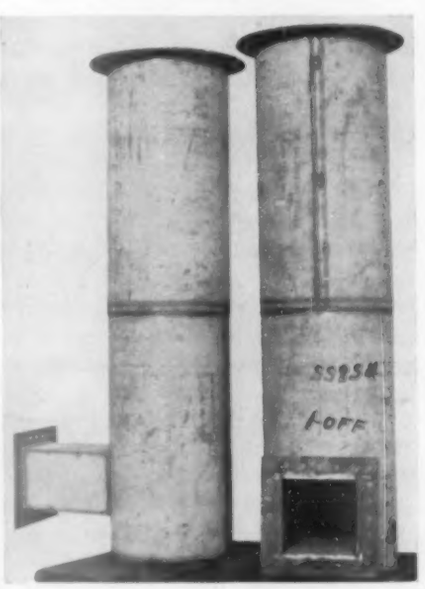
This intergranular corrosion is characteristic of the chromium-nickel alloys of higher content as well as those containing only 18-8, provided the carbon is over 0.08%.

When a piece of 18-8 and 18-8-S is welded together and subjected to acid attack in the as-welded condition and a similar sample exposed to the same acid but quenched from 1950 deg. F. in water after welding, they show clearly the effect of high and low carbon on welding and the necessity of annealing when the carbon is high, if the equipment is to be subjected to highly corrosive conditions.

Electric Arc Welding

Electric arc welding has been found to produce highly satisfactory results on stainless steels. Reverse polarity should be employed the same as when welding the nonferrous metals, such as bronze, aluminum, copper, etc. That is, the wire or welding electrode is connected to the *positive* terminal of the generator, and the work to the negative. This is directly opposite the practice used with common steel bare wire, but quite similar to the practice followed with heavy flux-coated rods of the shielded electrode type. While this will generally give

Gas cracking tanks of arc-welded Enduro 18-8



best results, it cannot be made a hard and fast rule. Some instances have been found, especially when heavy plates were involved, where straight polarity produced better fusion and penetration. However, for light plates up to 3/16 in. or so, reverse polarity is always advised.

Scarfing the edges is not necessary on anything up to 1/8 in. in thickness. For 3/16 in., if only one bead is to be laid from one side, it is advisable to scarf the edges on a 45 deg. angle to within 1/16 in.—3/32 in. of the bottom. With 1/4 in. or heavier, it is best to use two or more beads, scarfing from either one or both sides and leaving about 3/32 in. unbeveled at either the bottom or center, as the case may be.

Expansion Problems

The 18-8 has a high coefficient of expansion, about 60% greater than mild steel. In setting up any job this must be taken into account and allowance made. If automatic welding is used, such as the carbon arc, the edges will be clamped parallel the same as with ordinary steel, extra allowance being made only when movement is calculated. If a ring is to be welded to a flat circular sheet and a corner weld used, the sheet will bulge at the center due to contraction around the outside on cooling. For this reason it is more important than with steel to turn a one- or two-inch flange around the sheet and then butt weld the ring or shell to it, which permits the weld to move slightly without producing a buckle. For the same reason, it is advisable to have proper fixtures for holding the work in place while welding to prevent localized strains pulling at the joints which will happen if an attempt is made to weld a curved seam without some such support.

In the fabrication of general tank work in which light plates are employed, two general methods have been found quite satisfactory. In one case the plates are clamped in a jig. This consists of a heavy base with a copper chill bar, a narrow shallow groove running lengthwise along the center of one surface. Pressure is applied by two long bars beveled at an angle of about 45 deg. along the edges facing each other making an opening of 90 deg. The bars themselves are about 1 in. apart at the bottom and are so set that the groove in the chill plate will be in the center.

The sheets to be welded are then clamped in this fixture with the polished side down, in the case of polished sheets, and the edges held slighly apart and placed over the groove. The clamps are then applied from the top holding the two edges in place, while a weld is made from the unpolished or back side. The groove in this case acts as a mold holding the metal in shape to facilitate grinding in some cases, or merely to give proper reinforcing. This jig will be found satisfactory for flat straight seams. For circular or curved joints the same principle modified can be used, if economy as controlled by quantity production so warrants.

The second method used quite extensively, especially where a variety of shapes and sizes of products is made but not in sufficient quantity to warrant special fixtures, consists in fitting up the job for butt-welded seams and tack welding about every 2 in. on the back side. If any warping should occur, the joint can be straightened. A light weld penetrating about half-way through the sheet is then laid on the inside. A reinforcing bead is deposited on the outside, completing the weld. If grinding or polishing is required, the bead should be rough ground with either a bakelite or rubber bond wheel running about 10,000 ft. per min. When nearly flush with the sheet, cotton wheels set up with various sizes of the glue and abrasive should be employed.

Lower Heat Conductivity

The 18-8 also possesses a lower heat conductivity than steel. This tends to keep the heat of the arc localized at the point of contact, rather than allowing it to travel rapidly back into the plate. Due to this fact, together with its lower melting point, less heat is required for the same size plate and wire than is ordinarily employed. In other words, if 110-120 amp. were used with a 1/8 in. steel wire, we would need only about 90-100 on 18-8. Stainless will penetrate much better than steel because it is very fluid when molten, while ordinary steel tends to be more viscous and sluggish.

As previously mentioned, the alloys in stainless steel are chiefly chromium and nickel, the balance being iron. These products are highly resistant to heat, that is, they will not scale appreciably at high temperatures as long as they remain in the solid form, but will burn as soon as molten if exposed to the air. The iron and nickel will remain practically unaffected but the chromium will oxidize rapidly. Hence, in welding it is necessary to protect the molten metal from contact with the air.

In arc welding this is accomplished by applying a flux coating on the outside of the electrode which will fuse along with the wire. This protects the metal while going through the arc and covers over the deposited metal, excluding any air until the weld has solidified. If the coating is not of the proper type to afford the required protection, an imperfect or badly burned weld will result. If we should attempt to arc weld 18-8 with a bare rod of the same analysis a porous, leaky and generally bad-appearing bead will be produced.

Effect of Coating

In addition to protecting the metal, the coating should also have a stabilizing effect to assist in maintaining a steady arc. As the weld cools this slag covering will crack off to a large extent, due to difference in contraction between it and the metal. However, if a weld of more than one bead is to be made, all slag should be removed with an air hammer and caulking tool, or by some similar method, to guard against any being entrapped by further layers. This flux has a low melting point and any small particles remaining will generally be fused and floated to the surface by the heat of the next bead, but this should not be depended upon. This procedure will produce welds which on grinding and polishing will not show any blow holes, gas pockets or slag inclusions.

The flux which protects the metal must not contain carbonaceous material which will break down under the temperature of the arc and carburize the welded metal. Only 18-8-S should be used for electrodes and the carbon content of the deposited metal must be less than 0.08%.

Whenever welding the stainless steels, the same analysis welding rod should be used as the plate to be welded. This will produce not only a better diffusion between the weld and plate at the junction of the two, but will also give similar corrosion, physical and chemical characteristics between the two.

*(Concluding installment of Mr. Whitmer's article will be published in next issue.—*EDITOR.*)*

Bevel cutting an irregular shape with a portable flame cutting machine.

Fabrication costs
can be cut by using

Portable Machine Cutting

★ These extremely versatile production tools speed up the work and help the shop earn a profit

PORTABLE MACHINE cutting offers so many advantages in the speedy, accurate and economical fabrication of steel to shape that no metal-working shop can afford to be without this modern production process. Machinery and equipment manufacturers, steel fabricators, welding shops, and maintenance departments of mills and factories invariably find that the possibilities for profits with portable machine cutting are unlimited. The following review covering the many advantages of the process, the diversity of operations which can be performed, and the infinite variety of applications possible with small, portable cutting machines should prove helpful in indicating to metal-working shops how they can use these machines to speed production and lower fabrication costs.

Flexibility is perhaps the most outstanding advantage of portable machine cutting. Straight-line cutting, circle cutting, bevel cutting, and shape cutting are all performed with equal facility, and the machine can be brought to the work, instead of the work to the machine as is usually necessary with other fabricating processes.

This results in a number of economies. In the first place, investment in equipment is lower. A single, specialized job is handled just as readily as is regular production work. For the well-planned production shop, this means that proper organization permits almost continuous use of the machine.

Contract welding shops and maintenance departments find portable machine cutting equally economical because of the diversity of operations which can be performed. For a comparatively small investment, they have at their disposal a tool for quickly handling all their steel shaping requirements. This is particularly important to the small welding shop primarily engaged in repair.

Production is speeded because little or no set-up time is required for portable machine cutting. The time factor is particularly important to steel fabricators, where every order is a rush order. Portable cutting equipment permits accurate shaping of plates, sheets and billets to customers' specifications at a great saving in time and money.

In the fabrication of machinery and equipment, speed is often essential.

The flange of this dome-shaped tank top was cut off by using a 7-ft. radius rod.

Portable machine cutting in conjunction with welded fabrication is ideal from this standpoint. Material is taken from stock, quickly cut to shape, and welded into the required structure in minimum time.

Quite a number of shops turning out repetitive production items have devised special auxiliary fixtures to further speed the work. One shop which had a large order of plate to bevel devised a special supporting frame for its machine to run on. This made it possible to position the plate quickly by setting it in place against a stop. After beveling, the plate was just as quickly removed and another set in place. Savings in time and money on this operation, formerly performed by hand cutting, were considerable.

With portable machine cutting it is possible to turn out work of such uniform accuracy that in many instances no further finishing is required. This results in substantially reduced machining costs.

A typical example is the fabrication of a 42-in. diameter rotary for a snow plow. This part was formerly cut by hand out of ⅜-in. plate and then machined to secure the necessary smoothness and balance. However, portable machine cutting has now eliminated the necessity for any machining on the outside diameter.

Another advantage of portable machine cutting is that a considerable reduction in scrap or waste material can be made as compared with other methods for blanking out shapes from steel plate. Two factors account for this—(1) it is possible to cut right to the edge of the plate or slab, and (2) what would normally be waste material can be further utilized for flame-cut parts.

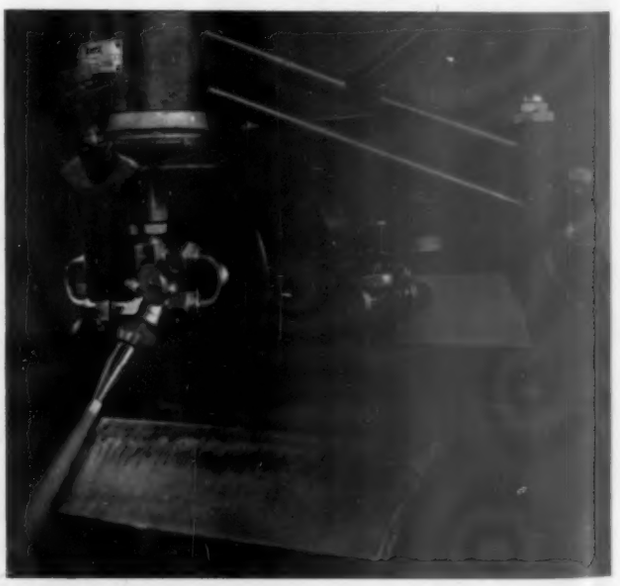
An example of this type of saving may be taken from the experience of a company which manufactures a special truck with a four-wheel drive. Considerable economies are effected by flame cutting a part which was formerly a forging. This is the front wheel ring clamp which is in the form of a ring—8½ in. outside diameter and 6⅜ in. inside diameter. It is cut from 2-in. plate at a total cost of $1.68 including labor and materials. The cost of fabricating this part by the former method was $2.24, and, in addition, it was necessary to machine the outside diameter of the forging. The important point, however, is that a further saving of $.80 is effected by using the flame-cut center waste portion to make the front wheel bearing cap.

In another instance, a cement plant is using the center waste portion cut from 14-in. diameter collars to make 8-in. diameter disks. These parts are used in the fabrication of large kilns. Recently, this same company used portable machine cutting to fabricate 100 elevator buckets. Approximately 20 ft. of flame cutting was necessary for each bucket and the savings were considerable as compared with the former method of shaping the steel plate with a power shear.

Still another advantage of portable machine cutting is that it is so adaptable for shaping steel for welded fabrication. Flame cutting in conjunction with welded fabrication results in parts which are strong and light. Products can be made better and more rigid, with the fabricated assemblies designed so as to combine various types of materials—such as plate, castings, and forgings—in a single structure.

A company which manufactures oil well drilling and pumping equipment uses portable machine cutting and welded fabrication in the construction of practically all its products. By the very nature of their service, this equipment must incorporate the maximum strength and rigidity. Typical of the parts shaped by portable machine cutting are the following: gusset plates and flanges for sampson posts; plates and hangers for walking beams; stirrups, flanges, and gusset plates for drilling and pumping pitmans; beams, flanges, gusset plates, and footing angles for jack posts; spokes, channels, center plates, and rims for band wheels and tug rims; plates, angles, and flanges for reduction gear base supports.

The number of operations possible with portable cutting machines is limited only by the skill and ingenuity of

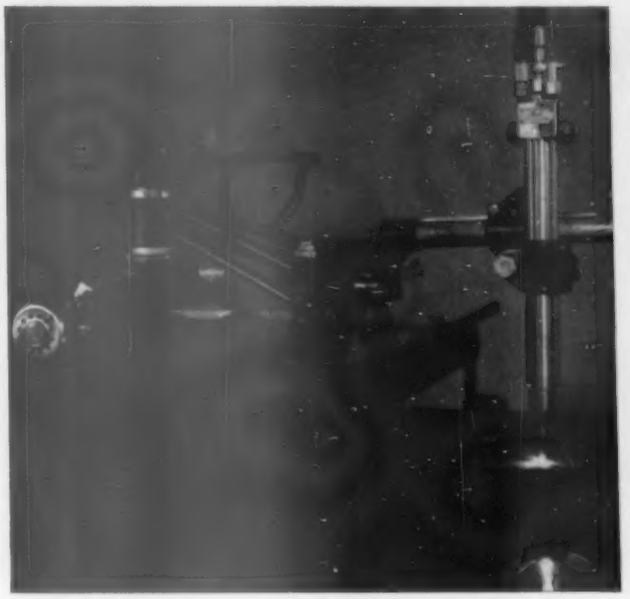


Straight line beveling is accomplished by using a track as a guide.

the operator. The general operations —straight-line cutting, bevel cutting, shape cutting, circle cutting, and heavy cutting—are illustrated with the accompanying photographs.

A study of the illustrations will undoubtedly suggest additional combinations and uses which should fit these machines for practically any requirement. For example, there is shown a flange being trimmed from a 14-ft. diameter dome-shaped tank top. This operation was made possible by constructing a special radius rod and anchoring it by means of a pin through the center of the top. Previously, the flange was hand cut by holding the blowpipe stationary and rotating the dome. This procedure produced an unsatisfactory cut, however, since it was impossible to control accurately the speed of rotation.

The convex dome segments were also flame cut to shape. In order to do this job, two rear wheels were specially built so that the machine could be guided by a 5/8-in. diameter round bar. The bar was bent to the curvance of the segment and the machine guided over the contour in the same manner that it would be in cutting the usual straight line with an angle-iron track.



By clamping the track to a simple frame, the user has a rigid machine for heavy straight line cutting.

Typical Applications

The following list of typical applications for portable machine cutting is included for its suggestive value. It is far from complete, but should serve to indicate the variety of work which is being performed. Many of the uses are, of course, equally adaptable to other industries where steel parts are extensively used, either in repair or production.

Heavy cutting is accomplished by attaching a large capacity blow pipe to the rear of the machine using a special fixture.

Aircraft. Cutting die blanks, gusset plates, flanges, and shapes; cutting in fabrication of jigs and fixtures.

Automotive. Shape, circle and straight-line cutting of parts used in production; cutting plate and sheet for body work; cutting brake hangers, cross members for frames, and tire racks; cutting parts used in maintenance.

Boilers and Tanks. Cutting shapes, circles, and handholes; contour cutting, beveling and trimming dome segments; beveling the flange of boiler heads; cutting and beveling disks.

Chemical Equipment. Cutting and beveling sheet and plate for vats, vessels, towers and structural shapes; cutting replacements parts; cutting pipe flanges and filter assemblies.

Electrical Equipment. Cutting circles, squares and rectangles in panel boards; cutting and beveling plate; cutting motor rings; stack cutting shapes used in production; cutting transformer tops to shape.

Excavating and Dredging Equipment. Cutting shapes for clamshell buckets and conveyor buckets; cutting side plates and wearing rings for suction pumps on barges; cutting in repair; trimming and edging parts for steam shovels.

Iron Works. Cutting circles and structural shapes; trimming heavy forgings; edging operations; slab cutting; cutting squares into rounds; splitting I-beams and channel iron.

Job Welding Shops. Ring cutting; plate edge preparation; cutting plate and flanges; cutting shapes used in connection with contract work; cutting parts used in repair.

Locomotive Works. Cutting cylinder cover heads; circle-cutting steel plate; cutting plate for tender construction.

Machine Shops. Cutting die blocks, cams, spiders, heavy wrenches, flanges, jigs and fixtures; cutting blanks for small gears, and hubs, spokes and rims for large gears; cutting replacement parts for welded fabrication.

Machinery Manufacture. Cutting bases for heavy machinery; cutting shears, rams and metal brakes; production cutting and beveling shapes for pumps and compressors; shape-cutting jigs and fixtures; cutting plates, flanges and gussets for traveling cranes; cutting out tractor parts; cutting parts for pump thrust bearings; cutting circles and rectangular openings in side plates for bottle washing machines; cutting shapes for dough mixing machinery.

Maintenance. Cutting safety guards, heavy wrenches and weight disks; cutting replacement parts for welded fabrication; cutting parts for repairing or revamping machinery.

Mining Equipment. Cutting side frames, brake rigging, spring hangers, bumper plates, deck plates, covers, pedestal straps, switch points, frog points, conveyor flights, sprockets, pipe flanges, washers and coal screens; squaring ends of old rail; beveling sheet and plate for hoisting drums, sand boxes, gear cases, mine car dumps

and switch boxes; cutting plates and flanges used in assembling mine cars, mine locomotives, and ore classifiers.

Pipe Fabricators. Beveling pipe and plate.

Railroad Cars. Cutting gusset plates and side sheet; trimming bridge plates; shaping side guides for air brake pistons; cutting service holes in center sills and bolsters.

Road Building Equipment. Cutting and beveling shapes for buckets; power shovels, derricks, pulleys, sheaves and scoops; cutting circular openings in dished heads of concrete machinery.

Scrap Yards. Cutting plate to shape.

Shipyards. Plate edge preparations; bulkhead plate trimming and beveling; shape-cutting laminated boat davits; cutting slots in rudder shafting; roughing operations on rudder posts.

Steel Fabricators. Shaping, trimming and cutting stock to size for shipment; cutting shapes and circles for fabricating purposes; cutting slabs and bar stock; cutting gusset plates and flanges; stack cutting quantity items; straight-line cutting T-beams; splitting I-beams and channels.

Steel Mills. Cutting stock to order; miscellaneous operations in plate mills and billet docks; cutting connecting rings for preheaters.

Miscellaneous. Cutting plate to shape for bases and tops of elevators; cutting in maintenance of metal furniture; cutting pipe flanges in power plants; cutting disks and collars for cement plant kilns; cutting and beveling shapes for pumping and drilling equipment; cutting shapes used in the manufacture of valves; cutting plate for the fabrication of oil refinery equipment.

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Job Welder Builds His Own Welding Shop

★ Edwin J. Soenksen, 1012—7th St., De Witt, Iowa, has been engaged in the welding business for 18 years, and for the past 9 years has been in business for himself. After renting a shop for nine years, Mr. Soenksen decided that he would be better off if he owned his own shop building. He decided that an all-steel welded structure would be effective in advertising his welding business, and it would also give him an opportunity to do a great deal of the work himself, thus effecting a saving in labor cost.

Mr. Soenksen's shop under construction.

Exterior of completed welded steel shop.

Edwin J. Soenksen

He built a small model of the shop he desired to build, making it to a scale of ½ in. equal to one foot. From this model he determined how much material would be required. After obtaining prices on various materials that would be needed, Mr. Soenksen decided that he could finance the construction of his own shop building. He decided to use second-hand boiler tubes 4 in. in diameter for the structural framework and roof trusses. These tubes were thoroughly cleaned and then cut to the desired length with an oxy-acetylene cutting torch. It required 2½ months to weld the various sub-assemblies before the building could be erected in the spring of the year. Roof trusses, wall studding, window frames and binder strips were shop welded.

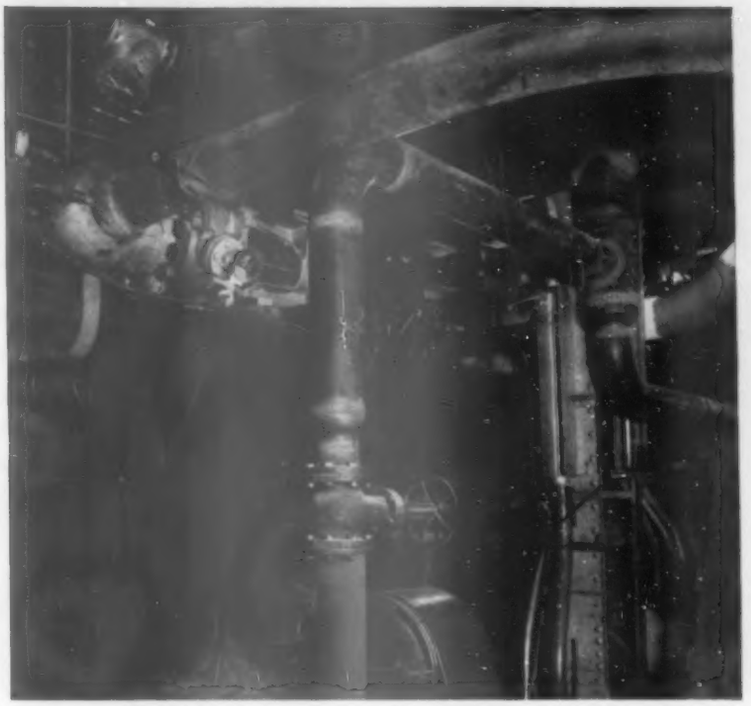
Following is a list of materials used in fabricating this welded welding shop:

12 tons of 4 in. boiler tubes.
10 tons of 16 gauge galvanized iron sheets for walls and partitions.
3500 lbs. of binder strips.
2800 bolts for holding steel wall sheets, windows and roof sheeting.

Mr. Soenksen furnishes the following estimate of cost on his building:

Boiler tubes at $26.00 per ton	$ 300.00
Labor and materials (about)	2,350.00
Mr. Soenksen's own labor	1,000.00
Total Cost	$3,650.00

This cost includes concrete floor and driveways, plumbing, electrical work and heating plant. The walls and ceiling are insulated with 1 in. Celotex or Insolite. This insulating material is placed between double steel panels.



Trend in power piping is toward higher pressures and higher temperatures.

Welding procedure for carbon-molybdenum

High-Pressure Power Piping

★ Welded joints are needed with high-pressure, high-temperature piping. Heavy coated electrodes produce required strength

HIGH PRESSURES and high temperatures employed in present day power plants make the use of modern welded joints in piping systems a necessity. Whereas, no form of flanged joint can be depended on to stand up for any great length of time under pressures of 1,000 to 2,500 lbs. per sq. in. and temperatures up to 900 deg. F., a welded joint properly made can be counted on indefinitely for complete freedom from service troubles and maintenance expense. Furthermore, welded joints assure neat appearing piping, eliminate all possibility of leaky joints, permit changes and additions to be made readily and make easier the application of insulation. In this article we present a digest of the procedure data contained in Bulletin No. 20, "Welding of High-Pressure, High-Temperature Piping," recently issued by Metal & Thermit Corp., 120 Broadway, New York City.

Only since the perfection of heavy coated electrodes has it been possible to obtain weld metal free of oxides and nitrides and having physical properties equal in every respect to those of the parent metal. The development of carbon-molybdenum electrodes, for example, which provide welds with all of the strength, ductility and creep resistance of the low-alloy steel piping employed for high temperature-high pressure service, has led to a number of installations of welded power plant piping.

Without exception carbon-molybdennm steel piping is used for high pressure high temperature lines in such installations. This steel is to some extent corrosion resisting. Its most important characteristic, however, is high strength and resistance to creep at elevated temperatures. The chemical analysis of carbon-molybdenum steel is generally specified as follows:

Carbon	.10 to .20%
Manganese	.30 " .60%
Silicon	.10 " .20%
Molybdenum	.40 " .60%
Phosphorus	.04% max.
Sulphur	.05% max.

Typical physical properties of such a carbon-molybdenum steel are:

Yield point	45,000 psi.
Ultimate strength	75,000 psi.
Elongation in 8 inches	20%
Reduction of area	40%

In addition to the selection of proper electrodes, there are three principal factors contributing to successful pipe welding. Because of the very nature of the work, it is essential, of course, that each and every weld be flawless and have the required physical properties. Such results can be obtained only when—

1. The weld design is correct.
2. A suitable welding technique is evolved.
3. A welding procedure and the welding operators are properly qualified.

A number of different types of welded joints for pipe lines have been designed and employed in the installations to date. Some of these designs

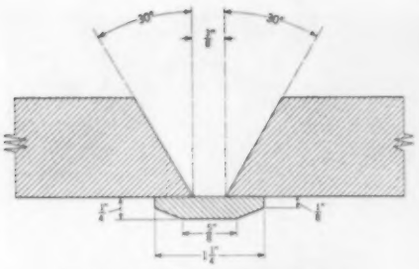


Fig. 1—Basic pipe joint design.

call for recessed and raised bead backing strips or chill rings; others involve upsetting of the pipe ends to permit recessing of the chill ring in the pipe wall without reducing the cross section at the weld; and still others require machining of pipe edges to form "U" grooves and bevels with lips of varying dimensions.

Good welds may be produced and entirely satisfactory results have been obtained with any of these designs. All things considered, however, the primary requisite of any weld design is weldability and, as a general rule, the more simplified the design, the easier it becomes for operators to produce sound and satisfactory welds.

Basic Joint Design

From this standpoint, the basic design, shown in Fig. 1, possesses many advantages. This design is intended for welds in plain carbon steel or carbon-molybdenum steel piping 2½ in. or more in diameter in the horizontal rolled, or "A" position and the horizontal fixed, or "B" position. It calls for a 30 deg. straight bevel of each pipe edge with no lip, with a plain chill ring of proper dimensions, and with a ⅜-in. gap at the root of the "V."

The chill ring is an essential feature of all pipe weld designs. Its purpose is to prevent formation of icicles and weld spatter inside the pipe and to provide complete fusion at the root of the weld. Chill rings are generally made of the same material as the pipe being welded. Since pipe walls may vary slightly in thickness and pipe is seldom perfectly round, it is frequently necessary, when using chill rings, to machine the pipe ends in order to provide true round inside contours and assure a good fit for the rings.

The ⅜-in. gap at the root of the "V" is recommended, because, while perfectly satisfactory welds can be made with smaller gaps, the larger space permits better manipulation of the electrode during welding, makes easier the laying down of the first few beads, which are usually the most difficult, and results in better welds.

The chill ring is not recessed in the pipe wall in this design, because in an investigation made for the Detroit Edison Co., at the University of Michigan, it was definitely determined that the slight reduction in inside diameter of the pipe caused by an unrecessed chill ring has no appreciable effect on steam flow. The additional expense that recessing entails, as well as any need for upsetting the pipe ends to compensate for reduced wall thickness, are thus avoided.

For several reasons the design is an improvement over those calling for "U" grooves or "V's" with pipe ends beveled to provide lips at the root of the "U" grooves, or in a "V" with lips, it is necessary for the welder not only to melt away the edge of each lip but also, and at the same time, to penetrate into both pipe wall and chill ring. This is not always a simple matter, particularly where the gap is too narrow to permit easy manipulation of the electrode, or in welding on the underside of a pipe in the horizontal position, where it is difficult for the welder to watch the arc.

Actually, the results of many tests show, for example, that other things being equal, more defective welds can be traced directly to this particular condition than to any other source. Fig. 2 (A and B) indicates the difficulty of producing sound deposits with welds of such design and shows how readily slag is entrapped and cold-shuts occur. Fig. 3, on the other hand, shows how, with straight beveled pipe ends and a gap of ample width, the welder can easily produce sound, clean deposits at the root by penetrating slightly into the chill ring and washing lightly up the pipe wall, first at one side of the root and then the other.

For welds in the vertical, or "C"

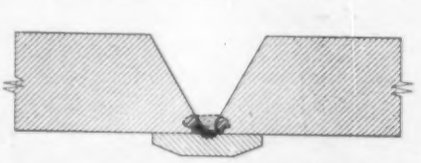


Fig. 2A—Example of welding difficulty where a V groove has a lip at the root.

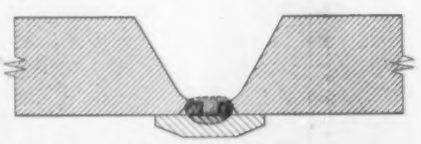


Fig. 2B—Welding difficulty where a U groove has a lip at the root.

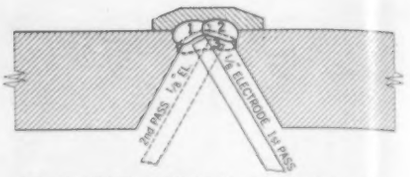


Fig. 3—With straight beveled pipe ends, the welder can do a better job.

position, the design is modified, as shown in Fig. 4. The bevel of the lower pipe edge is reduced to approximately 7 deg., while that of the upper pipe edge is increased to about 45 deg. The gap remains at ⅜ in. This design for vertical welds provides a nearly horizontal shelf for the operator to build on and makes every bead deposited practically a fillet weld. The welding technique is that of continuous fillet welding.

It is recommended that the design for horizontal welds, shown in Fig. 1, be employed for all welding on pipe in the horizontal position, as well as on pipe up to an angle of 30 deg. from the horizontal. Where the pipe to be welded is inclined at an angle of more than 30 deg. from the horizontal, the design for vertical welds, shown in Fig. 4, should be used.

For welds in the smaller diameters of both carbon-molybdenum and mild steel pipe, a 60 deg. included "V" design of weld, similar to that shown in Fig. 1, but with a 3/16 in. to ¼ in. gap and a ⅛ in. thick chill ring, may be employed in all positions.

Welding Procedure

When welding thick walled pipe, the deposition of a number of thin layers of weld metal by means of a multiplicity of passes is preferable to the use of a few heavy layers and a small number of passes. More satisfactory welds are thus assured. Such practice eliminates the possibility of porous weld metal and, at the same time, because of the refining effect of succeeding deposits upon each layer put down, a better grain structure throughout the weld is provided. On carbon-molybdenum pipe ⅛ in. alloy steel electrodes are employed for the first two layers and the 5/32 in. size for each of the succeeding layers. When welding in the horizontal fixed position, the ⅛ in. electrodes are used at approximately 90 to 100 amp. and the 5/32 in. electrodes at 130 to 160 amp. Where the pipe is rolled during welding, or, when welds are being made in the vertical position, slightly higher current values are employed.

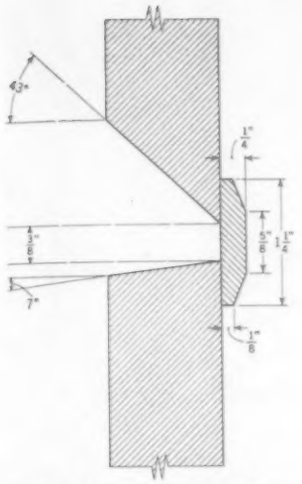


Fig. 4—Modified design for welds made in the vertical position.

For corresponding applications on mild steel pipe mild steel electrodes are used in the same sizes and at approximately the same amperages. In all cases the weld deposit is built up to approximately 1/16 in. beyond the outside of the pipe before the cover layer is applied. Proper grain refinement in the weld for the full thickness of the pipe wall is thus assured.

When making a weld of the design shown in Fig. 1, the backing ring is inserted in position in one pipe end and tack welded at several points along its inside edge. The end of the adjoining pipe, valve, or fitting is then brought into position, slipped over the free end of the ring and tack welded in place, leaving a ⅜ in. space between the beveled edges at the root of the gap. These tack welds in the "V" are made with a ⅛ in. electrode at 115 amp. The arc is struck and the electrode withdrawn slowly, leaving flat "shoe button" tack welds, which do not require chipping out later, but are readily washed away when the first welding bead is put down. This method of tacking avoids any possibility of injury to the chill ring, which might otherwise be caused by the chipping hammer.

In shop work, where pipe in horizontal position is rotated as welded, the first layer is deposited by weaving across the entire width of the gap at the root, penetrating well into the chill ring and washing lightly up the pipe walls at each side. The second layer is then deposited directly on top of the first layer and is also made the full width of the gap. Succeeding layers are put down as shown in Fig. 5. The electrode may be held perpendicular to the pipe, or inclined toward the welder at about 30 deg. off the vertical and slightly ahead of the top dead center of the pipe, allowing the slag to flow back of the deposited metal as the pipe rotates. In general, the perpendicular position is employed when high amperages are being used, while the inclined position has advantages when using relatively low amperages. Figure 6 illustrates the manner in which the electrode is held.

Horizontal Fixed Position

Welds on horizontal pipe in the field, where the pipe cannot be rotated, require a somewhat different technique. The first part of the weld is made at the 60 deg. sector, measuring approximately 30 deg. each side of the bottom dead center of the pipe, as shown in Fig. 7. The initial deposit is a bead confined to this sector and made as a fillet, fusing the backing strip and the pipe wall on one side of the root of the gap only. The second deposit is run both ways from the bottom dead center of the pipe and is put down in the same manner as the first bead, but on the opposite side of the gap and up to the 30 deg. point only. From this point it is continued as a full width layer up to the top dead center of the pipe on each side. The third deposit is also run both ways from the bottom center of the pipe and covers the first two beads, as shown in Fig. 3, while succeeding layers are made, as shown in Fig. 5. This method of welding eliminates the usual difficulties encountered on the underside of pipe in the horizontal fixed position, where, frequently, it is impossible for operators to watch the arc and where, therefore, a majority of defects ordinarily occur.

Welds in the vertical or "C" position are begun, as shown in Fig. 8. The first deposit is a bead, penetrating the chill ring and lower pipe wall; a second bead penetrates the chill ring and upper pipe wall and fuses with the first bead; succeeding deposits are put down as illustrated in Fig. 9, each bead being very nearly a perfect convex fillet weld. Care is taken in all of this welding to remove the slag thoroughly and to clean each bead or layer before the succeeding deposit is put

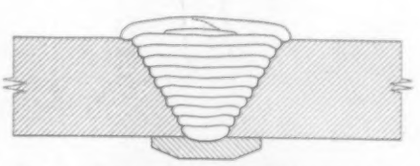


Fig. 5—How multi-layer weld is made in the shop on pipe in the horizontal rolled position.

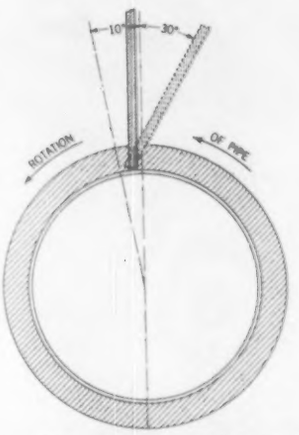


Fig. 6—How electrode should be held when pipe is in horizontal rolled position.

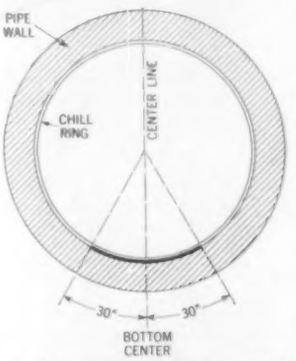


Fig. 7—Where the weld is started on horizontal pipe in fixed position.

down. This is done with a wire brush or a light hammer, following which the meld metal is smoothed with a chipping tool. The chipping operation may result in a slight peening effect, but is purely a means of cleaning and smoothing and possesses no value, as far as stress relief or grain refinement is concerned. The final or cover layer may be chipped smooth and peened lightly to give a finished appearance similar to knurling.

Preheating of Joint

Preheating is not necessarily an essential part of the procedure. Its purpose is to reduce the rate of heat conduction away from the freshly deposited metal, and to aid in refining the deposit so that coarse grain formations in the weld are avoided. The same objectives may be accomplished under ideal conditions without preheating, when highly skilled operators, using a well developed technique, are employed. Nevertheless, under ordinary circumstances it is usual to preheat the welding ends of all pipes, valves and fittings of both carbon-molybdenum steel and mild steel ½ in. thick or more. Customary preheating temperatures are from 400 deg. to 600 deg.

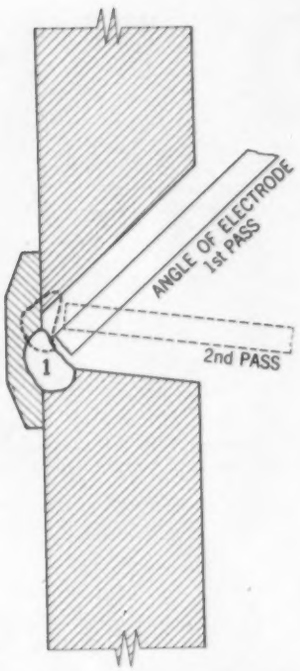


Fig. 8—How the weld is started on pipe in the vertical fixed position.

F., and heat is maintained in the work while actual welding is going on. It is not considered necessary, however, that the preheating temperature be maintained during intervals between welding operations, or during the interval between completion of the welding and the start of stress relieving.

A comparison of the physical properties of three individual weld specimens, one of which was neither preheated nor stress relieved, one of which was preheated but not stress relieved, is shown in Table 1, which indicates the effect of preheating when welds are made under ordinary conditions by operators of normal skill but do not indicate average results.

Preheating of welds in low-pressure lines may be done with gas torches, in which case the heat of the arc and an occasional application of the torch are depended on to maintain the necessary temperature in the pipe during welding. On high pressure lines in carbon-molybdenum steel pipe, however, where closer control of temperatures is required, preheating is done electrically. Pipe ends are enclosed in resistance or induction heaters and covered with a heavy coating of plastic insulation, leaving exposed only the surfaces to be welded. This procedure assures uniform preheating and maintenance of heat during welding. The insulation not only helps the parts to retain heat, but also protects the welder and permits using the same equipment for stress relieving without change or interruption.

Stress Relieving

To insure the elimination of locked up stresses, all welds in material ½ in. thick or more, require stress relieving. As a general rule, because of the creep-resisting properties of carbon-molybdenum steel, welds in carbon-molybdenum pipe require somewhat higher stress-relieving temperatures than those in mild steel pipe.

The stress-relieving procedure consists in bringing the welded joint slowly up to the proper temperture

Table 1—Effect of Preheating and Stress-Relieving

TESTS OF THREE WELDED SPECIMENS	
Specimen No. 1	No preheat or stress relief
Specimen No. 2	No preheat, but stress relieved at 1150 deg. for one hour and 45 min.
Specimen No. 3	Preheated 400 deg. to 500 deg., but not stress relieved
TENSILE TESTS	*Tensile Strength*
Specimen No. 1	66,470 psi.
Specimen No. 2	60,230 psi.
Specimen No. 3	65,500 psi.
FREE BEND TESTS	*Elongation*
Specimen No. 1 ($\frac{1}{16}$ in. fracture at 90 deg. bend)	27.7%
Specimen No. 2 (180 deg. bend, no fracture)	26.4%
Specimen No. 3 (180 deg. bend, no fracture)	43.8%
REVERSE BEND TESTS	
Specimen No. 1	O.K. through 180 deg., slight opening on one edge
Specimen No. 2	O.K. through 180 deg., slight opening on one edge
Specimen No. 3	O.K. through 180 deg.
NICK BREAK TESTS	
Specimen No. 1	Good fusion, no porosity
Specimen No. 2	Good fusion, no porosity
Specimen No. 3	Good fusion, no porosity

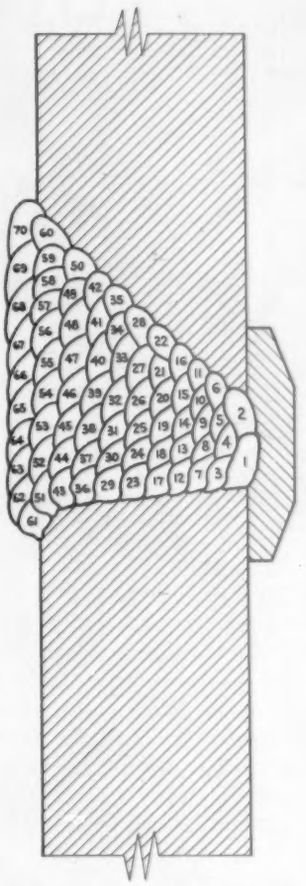


Fig. 9—How succeeding beads are put down on joints in the vertical fixed position.

and holding it there for approximately one hour per inch of wall thickness of pipe. The recommended stress-relieving temperature for carbon-molybdenum steel pipe is 1200 to 1250 deg. F., while for plain carbon steel pipe ample stress relief will be obtained at 1150 to 1200 deg. F. The distance along the pipe included in the heated zone is generally six times the wall thickness of the pipe each side of the weld. The heated zone is usually not allowed to cool more rapidly than 250 deg. an hour between 1200 deg. and 600 deg. When 200 deg. has been reached the insulation may be removed and the pipe allowed to cool in still air at atmospheric temperature.

Comparative free bend elongations and hardness of adjacent sets of carbon-molybdenum weld specimens, stress relieved at 1150 deg. and 1200 deg. indicate that advantages are gained through the use of higher temperatures.

Stress relieving of joints which have been preheated electrically is conveniently done immediately after completion of welding.

(Concluding installment of this article will be published next month.—Editor)

Arc welding the "feet" to a huge motor. Photo courtesy of General Electric Co.

Fourth of a series of practical articles on

Technique of Arc Welding

★ Part 4—Several procedures detailed for making fillet welds. What to avoid to get quality welds. How to weld lap joints

By ROY OWENS

Welding Instructor, Electro-Motive Corp., La Grange, Ill.

FIGURE 20 shows a fillet weld using a triangular motion. In using this motion, the electrode should be approximately 45 deg. from the horizontal plate and 10 deg. forward of the weld. When using this motion (on the forward stroke going into the corner) a very short arc must be maintained to fuse the corners and not bridge over. The arc should be lengthened slightly as the electrode is carried back on stroke 2 and down on stroke 3 and from there the cycle is repeated as shown in the sketch. A 3/16 in. electrode and 175 to 200 amp. will give the best welding results, except where an extra-heavy section is being welded. Such sections will require heavier heats. Any type of coated electrode can be used with this motion. This motion is not recommended for all welds of this nature, due to the time required in making the weld and because of distortion set up by heat radiation and residual stresses.

Figure 21 shows another motion commonly used in making fillet welds and one which will require the least effort on the operator's part to obtain a weld of superior quality. This motion is recommended for any thickness of work and for large or small welds and can be relied on for good penetration, when the correct procedure is followed. In welding ¼ in. plate a 3/16 or ¼ in. electrode will give best results using 200 or 250 amp. If a small filler is desired use a 3/16 in. electrode and for a larger filling use a ¼ in. electrode. The size of the work and the amount of filler desired will govern the size of electrode to be used. The weld will have deep ripples on the bead and will not be as neat as some of the previously described welds, but the quality of weld will be equal or superior. This motion is an oscillating back-and-forth motion with the exception that the electrode is drawn out of the corner on the back stroke from 2 to 3 and forward on stroke 3 to 4, the electrode being carried down in the corner slightly forward of the previous stroke. At this point a very short arc should be maintained to get good penetration and fusion in the bottom of the corner.

Figure 22 shows the electrode held too near the vertical plate in making a fillet weld which will cause an undercut on the vertical plate as indicated by the arrow and a steep shoulder on the horizontal plate. The arc flame will melt down the vertical plate along the edge of weld and it will not be refilled as the filler metal will be deposited directly in front of the electrode and will build up a steep shoulder on the horizontal plate. To correct this fault hold the electrode as indicated by the dotted line. The arc blast set up at the arc will force the molten metal upward in the undercutting zone instead of depositing too much on the horizontal plate. The weld will have equal depth of penetration on both pieces to be joined. To rework a poor weld of the kind shown in Fig. 22, put a stringer

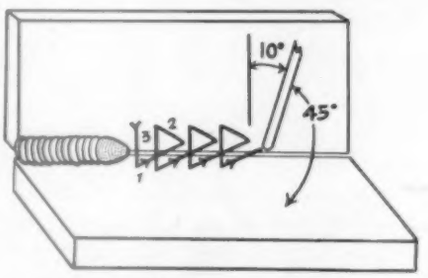


Fig. 20—Method of making a fillet weld, using a triangular motion of electrode—Very good on poor fits.

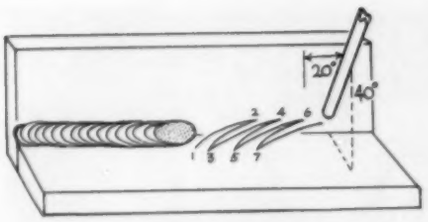


Fig. 21—An oscillating motion commonly used in making fillet felds.

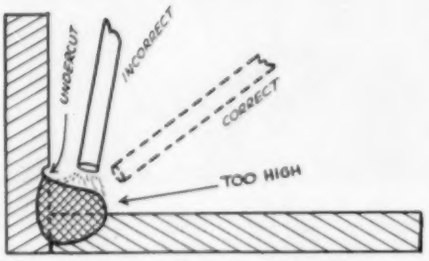


Fig. 22—How under-cutting is caused and how it can be corrected by changing position of electrode.

bead at the top of the weld along the line of undercut and allow enough filling to square the upper side of the bead to approximately 45 deg. and then with a small size electrode run a fast weld along the lower side of bead. By doing this the quality and appearance of weld will be improved. If such a weld is not reworked and is subjected to test by pulling the vertical plate backward, in all probability the weld will break at the line of undercut.

Figure 23 shows a fillet weld of the highest quality with good penetration. This weld is better than the average because the edges of the weld are feathered out to a perfect edge with a concave center. Figure 23 also shows a bead run at the bottom side of the work to complete the penetration. In joints of this type the operator will not encounter much difficulty in getting 50 to 60% penetration, on material ¼ in. or less in thickness, but any materials heavier than ¼ in. should be beveled to not less than 45 deg. on the horizontal plate. Fillet welds do not always require 100% penetration to equal the plate strength. If the bottom stringer weld is omitted, and pressure is applied as shown by the dotted lines in Fig. 23, a fracture will very likely start at the bottom of the fusion zone. In most cases welds made to withstand a compression load would have the larger weld put in from the outside corner first and then a weld on the inside, but much smaller than shown in Fig. 23. If the material is ¼ in. and a weld with ¼ in. build up was put in the corner with 10 to 20% penetration the weld would be considered equal to the plate strength because all fillet welds do not require 100% penetration.

Figure 24 indicates a weld which has too high a center and insufficient penetration. The most prevalent reasons for such a faulty weld are: Low heat; using a lightly coated electrode and choking the arc; moving the electrode too fast to allow the parent metals to become heated, causing filler metal to solidify before it has flown out properly. Welds of this type have little or no value and are also very clumsy in appearance.

Figure 25 shows a lap joint weld. Welds of this type should taper off to a 30 deg. angle instead of the usual 45 deg. angle. The reason for the long side is that on this kind of a weld it is easier to fuse to the end of the plate because the heat can radiate out only in one direction, whereas on the lower plate the heat radiates out in both directions from the weld. By making the weld taper off to a 30 deg. angle, more time will be spent on the bottom plate and this will insure better penetration and fusion. A 30 deg. angle will have almost double the weld surface of a 45 deg. angle, consequently a greater tensile strength and a neater appearance.

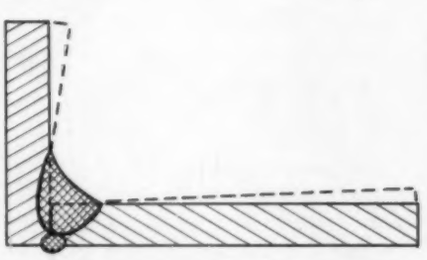


Fig. 23—A fillet weld which has good penetration, concave surface and edges which gradually merge with the plate material.

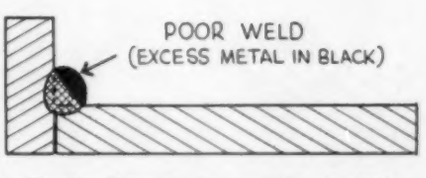


Fig. 24—Example of poor weld—too high a bead and insufficient penetration

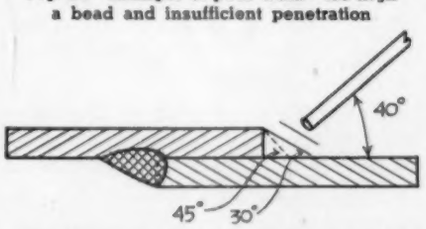


Fig. 25—In a lap joint, it is better to make a weld with a 30-deg. taper than with a 45-deg. tpaer.

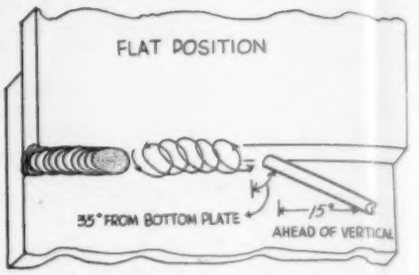


Fig. 26—Elliptical motion recommended for a lap joint weld.

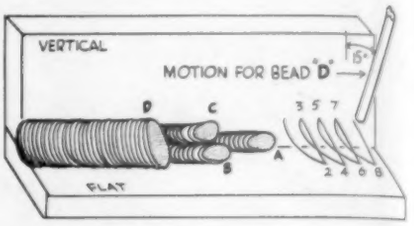


Fig. 27—Fillet weld make up of a series of stringer beads and a finish bead (for large fillets).

Figure 26 shows a motion recommended for a lap joint weld. This is an elliptical motion with the back stroke going over the upper side of the crater. At the heel of crater the electrode motion starts tapering down to the bottom and then forward to complete the ellipse. The electrode should be tilted about 15 deg. ahead of the weld and 35 to 40 deg. above the bottom plate.

Figure 27 shows a fillet weld put in with a series of stringer beads with a finish bead *D* put over the top for appearance. Bead *A* is put in as first pass, then bead *B* is put in lapping over half on bead *A*. Bead *C* is put over bead *B*, and if three beads do not give sufficient build-up, any number of beads can be put in starting at the bottom of the weld at the horizontal plate and running beads parallel to one another until the vertical surface is reached and then repeating until the desired build-up is obtained. It is important that scale be removed as the welding progresses. Bead *D* is put in covering all of the previous beads and giving the weld the appearance of a one-pass weld. On this bead all the metal is deposited on the downward stroke from *1* to *2* and the bottom of the weld will be built out ahead of the top to make a shelf to hold the metal. From *2*, the arc is carried up to *3* quickly and no metal is deposited, but at *3* there should be a slight hesitation to allow the arc time to fuse the vertical surface before moving from *3* to *4*.

(Fifth article of Mr. Owen's series will appear next month.—Editor.)

Welding—Major Tool of Industry

British Find Substitute Gases Inferior for Welding

By GEOFFREY BLACKALL*

★ In the development of gas welding in recent years, especially in connection with ferrous metals, a number of combustible gases have been employed in conjunction with oxygen. Acetylene gas is, of course, generally used, but various factors, in different countries and regions may combine to advance the use of one or more alternatives. In districts where coal gas is cheap, the fact that a supply is usually available for heating, may lead to its adoption for welding also. Similar reasons have stimulated the use of natural gas where supplies are conveniently available. In Continental Europe, methane and propane are extensively employed, while ethylene and benzol are other substitutes occasionally adopted.

The selection of a suitable gas in particular circumstances, while often based primarily on its availability and cost, together with the prime cost of equipment for storage and use, needs to be considered even more carefully from the heat generation standpoint. This is very important when the flame temperature required must be high enough for the welding of ferrous metals. Some valuable comparative data on this aspect of gas-welding practice, compiled by the Acetylene and Welding Consulting Bureau, London, indicates that many of the unsatisfactory welds sometimes experienced with these substitute gases are probably the result of the variations liable to be encountered in their composition and calorific value, and insufficient appreciation of the adjustments necessary to allow for these variations.

Taking the melting temperature of the metal at an average value of about 1,600 deg.C. (2912 deg.F.) it is apparent that the combustion of oxygen and any gas employed with it must be capable of maintaining a constant flame temperature in excess of this value to compensate for the inevitable losses of heat by radiation and conduction. The fact that more than one-half the theoretical quantity of oxygen required to maintain the combustion is obtained from the surrounding atmosphere, makes a further reduction in flame temperature, for which compensation must be provided, so that the actual temperature of combustion must be of the order of 2,000 deg.C. (3632 deg.F.) to ensure satisfactory performance.

Gases Are Not Uniform

It is axiomatic that any gas used for such a purpose must be constant in quality and chemical composition, and lack of uniformity in these respects probably accounts for the large proportion of unsatisfactory welds experienced with the substitute gases mentioned and the combinations of them that have occasionally been tried.

For example, coal gas is a mixture of several gases, present in varying proportions in different areas. In Britain the calorific value of coal gases varies from 560 B.T.U. per cu. ft. in London to 280 B.T.U. in Nuneaton. The latter case is admittedly exceptional, but a variation of 10 per cent between adjacent districts is not abnormal. Moreover, the composition of city gas is so complex by comparison with that of acetylene that uniformity is difficult to obtain even within the limits of a single supply system.

The gas now supplied by most companies is a mixture of 75 to 80 per cent straight coal gas and 20 to 25 per cent carburetted water gas. An analysis of straight coal gas of 520 B.T.U. calorific value per cu. ft., which may be taken as typical, showed hydrogen 47 per cent, methane 27.5 per cent, nitrogen 10.5 per cent, carbon monoxide 7.75 per cent, carbon dioxide and unsaturated hydrocarbons 3.5 per cent each, and oxygen 0.25 per cent. A corresponding analysis of a sample of acetylene gas obtained from a generator revealed that impurities accounted for only 0.36 per cent, 99.64 per cent of the sample being pure acetylene.

Generally speaking, however, it is insufficient heat and varying flame characteristics rather than the presence of harmful constituents which limit the utility of coal gas for welding, despite the common belief to the contrary. Sound welds have been made with coal gas in steel up to ¼ in. thick, but the deficient calorific value usually restricts its economic application to steel not over ⅛ in. thick. The design of a blowpipe to use coal gas must ensure very thorough mixing, as the different constituents have different rates of flame propagation and different oxygen demands.

All of the flames mentioned, with the exception of the oxy-acetylene have temperatures below that at which water vapor dissociates; and as water vapor is a product of the flame, some oxidation inevitably takes place when steel is welded by using a gas other than acetylene. The oxidation due to the flame itself can be overcome by a thorough mixing and the use of an excess of combustible gas, but the oxidation due to atmospheric oxygen still remains.

Various attempts have been made to reduce the cost of oxy-acetylene welding by mixing other combustible gases with the acetylene. In the Koerner and Frama processes, for example, coal gas is utilized in this way, special mixing apparatus being employed, with which any desired proportion of mix may be obtained. In the Frama process, introduced a few years ago, a saving of 10 per cent of oxygen and 25 per cent of acetylene has been achieved by this means, without any reduction in welding speed. However the rather complicated supplementary system of regulators, oil filters, and numerous valves and cocks militates against its development. If the process could be simplified it would probably advance more rapidly.

After consideration of all the available evidence, the Bureau has arrived at the opinion that the simple mixture of oxygen and acetylene appears to offer economic advantages sufficient to ensure its continued employment in most future applications of gas welding.

* Special correspondent, *The Welding Engineer*, London.

Evolution of a Welded Oil Pumping Unit

By B. K. SMITH*

★ On July 5, 1919, I visited Houston as a "peddler" of welding equipment and called on the Lufkin Foundry & Machine Co. at Lufkin, Texas. I wondered then if the foundry and machine company was named for the town of Lufkin, or if the town was named for the Lufkin Foundry & Machine Co. It was then a large institution in a small town, recognized in all sections of the Southwest.

An example of the advancement and progress made by this company is shown in the illustrations. Figure 1 shows a Lufkin pumping unit made in 1932, using rivets, bolts, and some welding, in its construction. This pumping unit was accepted by the oil industry as a good unit and there are still some of them in use. In 1933 improvements were made in the Lufkin pumping unit as shown in Fig. 2, using less rivets, less bolts, but more welded joints. Figure 3 is a detail view of the welded equalizer.

*President, Big Three Welding Equipment Co., Houston, Texas.

Fig. 3—Latest type of welded equalizer.

Fig. 1—Lufkin pumping unit made in 1932.

Fig. 2—In 1933, the Lufkin unit was designed with more welded joints.

Welded Transfer Trucks for United Shipyards

★ Dravo Corp., Pittsburgh, Pa., has received an order from United Shipyards, Inc., Crane Plant, Brooklyn, N. Y., for the construction of six special barge transfer trucks. These trucks are of Dravo design and are used to transfer barges and barge sections in the welding assembly shop.

The trucks consist of a four-wheel carriage and a platform cover. The carriage is fitted with four hydraulic jacks, one in each corner, welded to the carriage structure beneath the lifting platform. An integral jack in the center is provided so that the cars may be lifted above the rails in order to change direction. A hand-operated hydraulic pump supplies oil under pressure to raise the platform jacks, and each car is able to lift 120,000 lbs. a distance of 4 in.

Welded trucks for transfering barges and barge sections in the welding assembly shop.

» «

Improving Service Truck

★ By the use of cutting and welding equipment the usefulness of this service truck was greatly increased. A chain hoist, carried on a folding overhead track, will quickly raise a motor, or other heavy equipment, from the ground and carry it forward into the truck. With the track extended it is used in towing. An acetylene unit is carried in the front of the body, the tanks being clamped in two 18-in. sections of old well casing which have the bottom end plugged and extend through the bottom of the body to a steel plate to which they are welded. The plate is bolted to the bed, so as to be removable.

A bow, made by heating and bending sections of 1 in. by 3 in. channels, was installed at each end of the body.

Welding helps repair man fix up his service truck.

The ends of the rear bow are bolted to triangular formed plates, welded to the corner of the body and bolted to the bumper holder on the chassis. This serves to properly distribute the weight when a load is on the hoist. The arch of the rear bow is strengthened by a 2-in. bar welded between the flanges. At the middle is welded a strong 3-in. hinge, with wing members to prevent side-sway. This holds a 4 ft. extension of the 2 in. by 4 in. I beam, on the flanges of which the hoist can be moved. The extension is flush with the main section of the beam when extended. The main beam is welded to the bows.

In towing a car the extension is elevated somewhat by a chain hooked into one of several holes drilled near the outer end and bolted into a clevis welded on the top of the main beam. This clevis is also used to secure the extension beam when it is folded back on the other section. Sloping sideboards on the body were bent down to horizontal, braced underneath with triangular welded plates, and used to support 12 in. by 16 in. tool boxes.

» «

Welded Gasoline Transport Truck Is Streamlined

★ Most people associate streamlining with pleasure cars and regard it as simply the designer's way of giving modern cars that "racey" appearance. That streamlining must and does have some practical value is said to be indicated by the increasing number of streamlined trains and buses. It conserves power and saves fuel by reducing wind resistance.

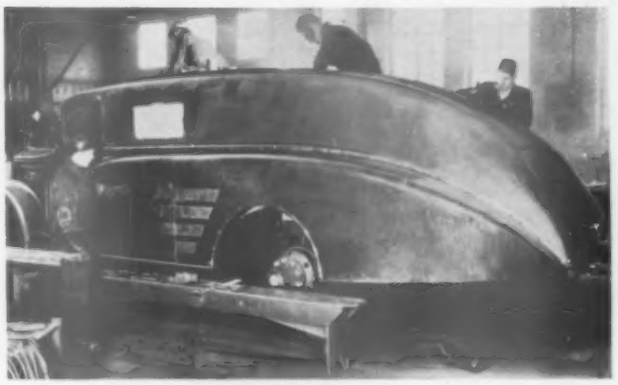
The modern streamliner illustrated here is a 1,000 gal. gasoline transport tank truck built by the Columbian Steel Tank Co. of Kansas City, Mo., for the Continental Oil Co. As in the case of other "streamliners" the tank truck construction is arc welded. According to the builders, welding made the design of this particular type of body possible. Welding was done with shielded-arc equipment supplied by The Lincoln Electric Co.

» «

Hand Truck Made from Arc Welded Scrap Steel

★ When it became necessary to have a truck for moving equipment around in the Kansas City, Mo., office of The Lincoln Electric Co., the first thought was to build the truck with a timber framework. It was found, however, that wood construction would not provide the desired strength. The solution was the construction of a truck out of scrap steel joined together by electric arc welding.

Simple hand truck made from scrap steel.



Transport tank under construction by arc welding.

Two 6-ft. lengths of 6-in. channel, two 6-ft. lengths of 3-in. channel and 3 pieces of 3-in. pipe were delivered from the junk yard. One hour and 15 min. after delivery of the steel, a truck, strong enough to carry 3,000 lbs., was ready for service.

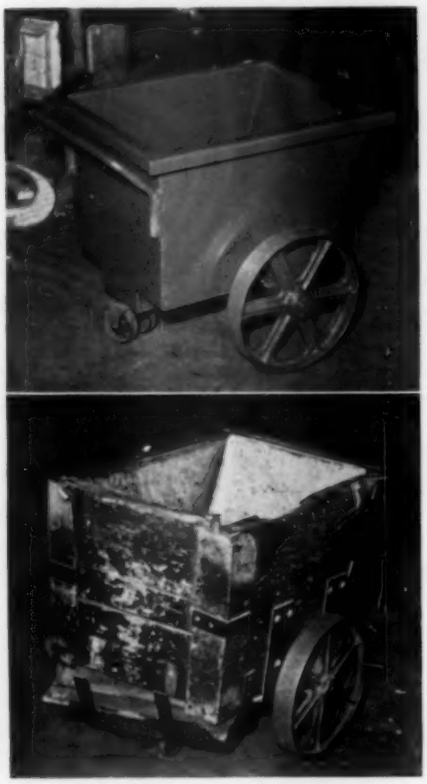
The total cost of the truck was only $5.00. The only tool required was the 150 amp. Lincoln welder shown in the background.

» «

New Type Wagon Is Arc Welded

★ Used type in a newspaper plant is ordinarily remelted, molded into "pigs," and recast into new type as it is needed. Type metal, however, is heavy and the small wagons which printers sometimes use to haul the old type from the composition rooms to the melting pots have to withstand a great many hard knocks.

When the Tessier brothers, Andrew and George, who operate a machine



The welded steel "type wagon" is certainly an improvement over the old wooden veteran.

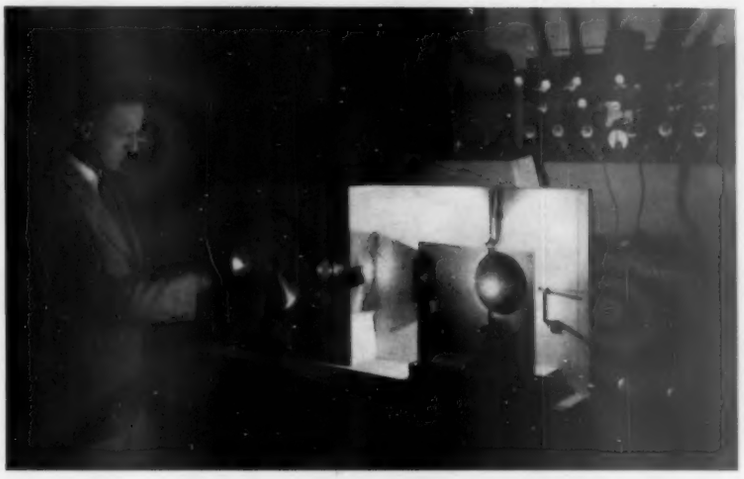
shop in Schenectady, N. Y., were asked to repair a battered type wagon for a local printer, they suggested building an all-metal one by welding. They cut the necessary parts from 10-gauge steel plate, joined them together with the aid of a General Electric gasoline-engine-driven arc welding set, bolted the welded box to the original axle and wheels, and, except for a coat of paint, the job was done.

» «

Man-Made Arcs Surpass Heat of Sun

★ For years man has been beating the sun's heat with his electric carbon arcs and didn't know it. Scientists had even come to the conclusion that electric arcs were far under the sun's temperature. It was by photographing sound as it passed across these arcs that Dr. C. G. Suits of the General Electric Research Laboratory in Schenectady, N. Y., discovered the true temperature of the hotter arcs.

Carbon arcs flame at 9,400 deg. F., tungsten at 11,300 deg. F. and some of the new welding arcs momentarily at more than 13,000 deg. F. Since any conceivable kind of thermometer would melt in this heat, Dr. Suits used sound waves to measure the temperature, employing certain laws of physics.



Dr. C. G. Suits pointing to laboratory equipment used in measuring arc temperatures.

Under these laws, the speed of sound in the air is known to depend on the Brownian movement of the molecules composing the air. The Brownian movement is merely the fact that they are bumping each other, propelled by their self energy. Since this energy is heat, the hotter the air, the faster its molecules fly and the oftener they hit each other. It is this bumping which transmits sound, the speed of which at normal conditions is 1,090 ft. per second.

In a bright gas flame, sound travels by exactly the same principle. Furthermore, in the gas flame, it is visible as a wave, an increment of added vibration in molecules already vibrating so fast with heat that they glow with light. Dr. Suits arranged a whirling mirror to photograph these sound waves in electric arcs. His camera catches the motion of a sound wave for a two-millionth part of a second. In this way, its velocity in the arc can be seen. The velocity in turn gives the heat of the arc.

» «

Longest String of Welded Well Casing

★ The longest string of welded casing used to date was set recently by the Carter Oil Co. in their Carter-Harley No. 1 well near Milroy in Carter County, Okla. The length of the string was 8,100 ft.

The National Tube Company's 7-in. OD, 26-lb., range 3, special casing was used. Two types of joints were welded, the "U" bevel on plain end pipe and the "V" bevel, commonly used on shorter strings.

Welding one of the joints on the 8,100-ft. casing string installed by Carter Oil Co.

The job was completed successfully without encountering any difficulties. In testing after the casing was set, pump pressure was built up to 1,200 lbs. and allowed to stand for 45 min. at the close of which period the pressure had not diminished, indicating that the work was a success.

Among the welding equipment used on this job were 300 amp. dual continuous control Lincoln arc welders and Shield-Arc 85 electrodes.

New Product Developments

USL Transformer Type Electric Arc Welder

★ A new a-c. welding machine is being announced and placed on the market by the Owen-Dyneto Corp., Syracuse, N. Y. It is being marketed under the trade name "USL Protected Arc A.C. Welder." USL d-c. welding units have been manufactured for 22 years by this same organization and affiliates.

Features of the new a-c. machine: It is designed to connect to any standard voltage or frequency power line. It is rated at 150 amp. and has a range from 30 amp. to 280 amp. Open circuit voltage is 55 volts, maintaining 20 volts to 30 volts across the arc. USL engineers state that the new unit was designed to fill a demand for an a-c. welder that would meet the most gruelling service requirements over a long period of life and still be within the range of popular price welders.

Simplicity of control is featured in the new USL Protected Arc A-C Welder.

The "Protected Arc A-C. Welder" is constructed in various details so as to speed up the welding process. It accommodates any commercial type of a-c. welding rod. It is built to give thorough penetration for heavy work, yet it can be cut down to the lower heat requirements for welding thin sheets. Numerous tests in the welding of stainless steels have shown satisfactory results, USL engineers claim. The size of rod that can be used ranges from 1/16 in. to ¼ in.

A steady arc is secured by means of a reactor on the secondary winding of the transformer. This stabilizer creates a power influx where the current cycle passes through the zero point. The arc is therefore constantly maintained and results in faster, easier welding with less spatter loss, it is claimed. Simplicity of control is emphasized by the single dial which permits of setting the machine to the requirements of the work and operating it without further attention. It is free from relays and magnetic switches, and has no moving parts.

Construction of the unit is aimed at ruggedness, simplicity and fool-proof operation. The transformer is constructed of silicon steel. The coils are flat wound copper. Both the coils and the iron are impregnated and baked. All connections use flat bus bars, and all leads are given careful right-angle bends that entirely eliminate interference and possibility of short circuits. As another safety precaution, the transformer is insulated from the welder box. The design provides for ample size of copper, which, together with the high capacity iron, keeps down the heat and prevents overloading. In appearance the new USL unit is very compact. The case is crackle finished in black. Two stout handles and four large casters make it easy to move. Total weight is 190 lbs.

» «

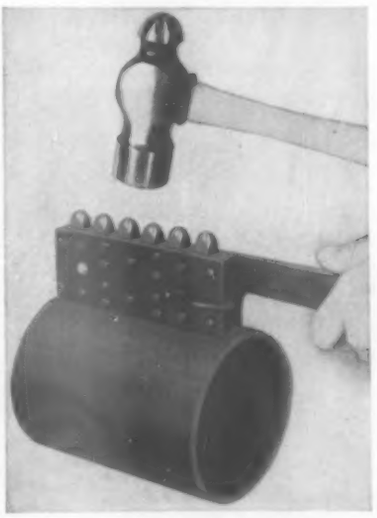
Safety Tube Stamp Holder for Marking Metal Products

★ The M. E. Cunningham Co., 180 East Carson St., Pittsburgh, Pa., has recently perfected a safety tube stamp holder which is designed to hold safety steel stamps securely during the marking of objects. Although the tube holder is not made of safety steel, it is designed to promote safety in production and to eliminate haphazard stamping on tubing and curved objects where both single and multiple characters are required.

This new safety tube holder can be made for a single stamp or any quantity of stamps where straight line stamping is desired. If the surface to be stamped is flat, it is also possible to have a holder made for two lines, one of which might be for a trademark on the top line and a series of stamps on the second line to designate dating, inspection, or any other necessary information.

The extended handle assures a firm grip of the holder and added protection where a heavy hammer is used by the operator or his helper. The means of holding the stamps in the holder is a simplified pin that extends through the pocket and is held in place by a spring fit. The stamps are slotted so that the pin will hold the stamp in place when raised from the object to be marked. Safety steel stamps as used with this holder assure even heads on the stamps, so that each one can be easily struck with a hammer without spalling or mushrooming.

The holder made for tube stamping is notched at the bottom to assure a firm seat on the tube. The manufacturer will gladly furnish literature and prices upon request.

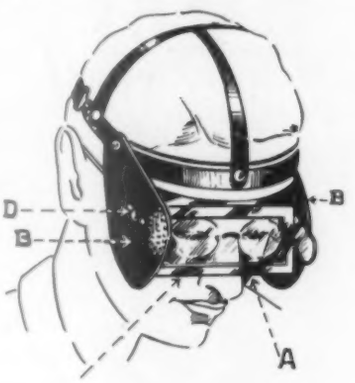


Safety tube stamp holder for marking welded products.

» «

Jackson Eyeshield Offers Wide Vision and Comfort

★ A new means for eye protection is afforded by the Jackson Eyeshield, a device that, while not intended to replace goggles for all uses, in many instances is claimed to be better. This overall eyeshield consists of a comfortable, light headgear to which is attached an adjustable assembly consisting of a lens frame *A* and two side protection



The Jackson eyeshield features wide vision, lightness, and comfort.

members *BB*. The entire assembly can be pushed up, out of the way *C* when not in use. The lens frame swivels at *D* to adjust the lens angle and provision is also made for the easy adjustment of the distance of the lens from the face. Standard Federal

specification lenses are used, protected by cover glass.

The eyeshield is made in three types. One type for blow torch work, gas cutting and general maintenance welding, has a lens frame and side pieces of light, opaque material, the frame fitting the face closely and comfortably. Another model, for the use of men working on gun, spot and flash welding, pouring metal and general grinding operations, has a lens frame and side protection shields of transparent non-inflammable material, affording maximum vision. A third model is designed particularly for the use of gas welders on automobile body work and similar production operations and for gas welding inspectors and welders' helpers. The lens frame is cut away sufficiently on the under side to allow vision *under* the lens as well as *through* the lens, without adjusting the lens frame. This allows the wearer to walk around his work easily, pick up tools and so on, without danger of accident.

Advantages claimed for these shields include: Wide vision, lightness, no irritation of nose bridge. The manufacturers, Jackson Electrode Holder Co., Detroit, Mich., assert that experience has shown that workmen willingly wear these shields in proper position, thus avoiding injuries that may result from the improper adjustment of some types of eye protection devices.

» «

Mallory Introduces New Welding Tip

★ Realizing that its welding tip alloys needed a better tip design to yield their full value, P. R. Mallory & Co., Inc., Indianapolis, Ind., has introduced the new type pointed welding tip in a complete range of standard sizes. Mallory engineers worked closely with machine manufacturers and users of resistance welding in order to secure the best design. Many different designs were tested by thousands of welds on the most modern spot, gun and other welders, both in the Mallory laboratories and in production shops. Overloads were used to prove strength and disclose weakness in design. Welding tip nose forms, water hole depths, wall thickness, etc., were tested to determine the best design for maximum efficiency.

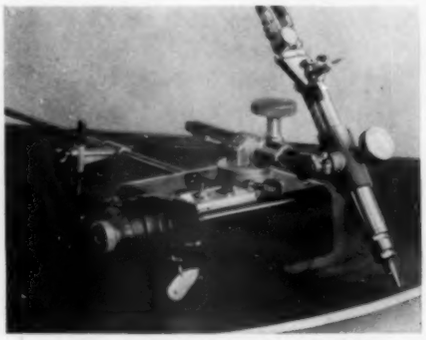
Mallory production engineers also developed a new way to fabricate this tip in order to get greater uniformity in strength, hardness and electrical and thermal conductivity with consequent longer life than has heretofore been possible by other means. The nose of the new tip is sturdier in design—which makes for longer life. Mallory's new process is claimed to insure uniformity of metal from the welding face down to the water hole. The length of this section is proved by test to produce more welds with proper cooling. The round bottomed water hole provides streamline cooling with no corners to trap steam. This process permits a proper hole depth without decreasing wall thickness, or reducing the current-carrying capacity in the section of the tip at the bottom of the hole.

With the new tip, Mallory also announces a complete standardization in types and sizes of all spot welding tips and water-cooled holders. Over two years of work with machine manufacturers and users of resistance welding processes have resulted in the establishment of a complete line of standard tips and holders for all applications. This program should bring lower costs to the user as well as improved service because of the immediate availability of all types and sizes from stock.

» «

New Airco-DB No. 10 Radiagraph

★ The Air Reduction Sales Co., 60 East 42nd St., New York City, has added to its extensive line of gas cutting machines, the new light-weight No. 10 Radiagraph. The low price of the No. 10 Radiagraph places it within the purchasing range of most shops that cut steel slab and plates and provides for industry an unusual value in flame cutting machines. The No. 10 will cut bevels up to 45 deg. and needs no extra attachment for this type of work. Square edges and straight lines of any length desired may be produced and complete circles up to 85 in. diameter can be cut, using the radius rod and center point. Weighing only 41 lbs., it is extremely portable and can be carried from job to job with no appreciable effort.



Airco-DB No. 10 Radiagraph is suitable for bevel cutting.

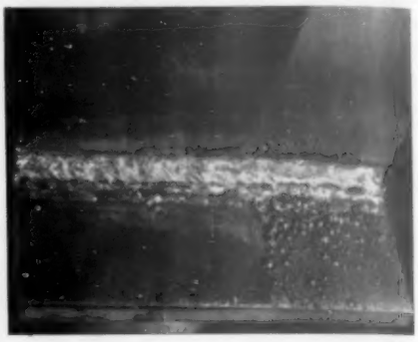
Included with the machine proper are the following, which comprise the standard equipment: Torch adjusting unit—standard Airco-DB machine cutting torch—torch wrench—3 conductor lead cord 25 ft. long—radius rod and center point—one length of track—one cutting tip as selected.

In addition, the No. 10 Radiagraph embodies these important features:

1. A cutting speed of from 4 to 60 in. per min. with modern indexed speed control for quick setting up and operation.
2. Free wheeling for easy lining up to the work.
3. Simplified horizontal and vertical torch adjustment.
4. All controls positioned for maximum convenience.
5. All working parts completely enclosed.
6. Operation on 110-volt a-c. or d-c.

Prevents Weld Spatter from Adhering to Metals

★ A new material (Glyptal No. 1294) has been announced by General Electric for prevention of adhesion of weld spatter to metals which are to be welded. This material, which can be used without harm on any metal surface, including polished stainless steel, will not produce carbon to make the weld hard or brittle, nor will it reduce ductility. Likewise, it will not give off smoke



Metal at left was sprayed with Glyptal No. 1294 before welding.

to fog up the atmosphere and it will not form gas pockets or cause the weld to be porous, it is claimed.

In applying the new Glyptal preparation, spraying is preferred to brushing, because the former method assures a thinner coat. A thin coating will protect the work as well as a thick coating, if the surface is completely covered, is more economical, and dries faster. On surfaces which are to be painted, this material further serves as an excellent priming coat. In addition, it prevents the forming of rust on steel in storage yards. This is particularly important if the steel is to be subsequently welded. The new preparation will withstand temperatures up to 600 deg. C. for one-half hour; after this length of time it will begin to evaporate.

» «

Smootharc "Harstain" Electrode for Stainless Steel

★ The Harnischfeger Corp. of Milwaukee, Wis., announces Smootharc "Harstain," an electrode designed for welding such brands of chrome-nickel stainless steel as Enduro, KA-2, Allegheny Metal, Uniloy, Duroloy, etc.

"Harstain's" base metal contains 19% chromium, 9% nickel—a higher content of both elements than in the usual 18-8 type of stainless steel. This prevents nickel and chromium content of the weld from dropping below the analysis of the parent metal. Carbon content of the base wire is below .08% to insure high resistance to corrosion. Columbium is added to prevent carbide precipitation, the cause of inter-granular corrosion.

The coating is designed to give the arc maximum stability and to protect the metal against oxidization or atmospheric contamination. This is accomplished without the use of calcium chloride. Manufactured in sizes

from 3/32 in. to ¼ in. in diameter, Smootharc "Harstain" is available in standard lengths of 12 in. Further information can be obtained by writing to Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.

» «

Marquette Announces a Complete Line of Electrodes

★ Marquette Mfg. Co., Inc., of Minneapolis Minn., now markets a complete line of arc welding electrodes. Trade names are Grey-Rod, Brown-Rod, Blu-Rod, Tung-Rod, Mang-Rod and Stain-Rod.

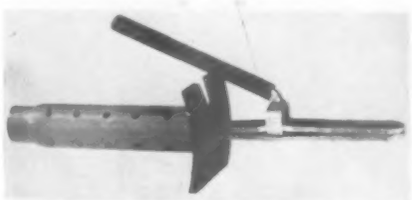
The Red-Rod is the standard, and most popular of these electrodes. It is designed for flat, vertical or overhead welding of light-gauge sheet metals such as fenders, bodies, etc., up to heavy steel beams and castings. It has a heavy coating of organic material, as have all Marquette rods. The coating is applied by an extruding process, thus assuring uniformity of mixture and coating thickness. This coating not only acts as a shield for the arc, but also unites with impurities in the molten metal to form a slag which rises to the surface leaving a dense, ductile weld of high-tensile strength.

The other Marquette rods named above are designed for various types of jobs such as cast iron and stainless steel welding, and for A-C. or D-C. machines.

» «

Duro Junior Holder Weighs Only Nine Ounces

★ Weighing only nine ounces, the new Duro Junior holder for metallic arc welding is designed for light precision work and can handle currents up to 200 amp. It is ruggedly constructed and includes the important features which are standard on the larger sizes of Duro holders. All parts are easily renewable. The Duro holder may be supplied with soldered or solderless type connection and with insulated or non-insulated handle. For prices and further information write to Churchward Engineering Co., Inc., 33 Sperry St., New Haven, Conn.



Duro Junior holder weighs but 9 oz.

» «

New Lincoln Electrode for Arc Welding High Tensile Steel

★ The Lincoln Electric Co., Cleveland, Ohio, announces a new electrode for the construction of pressure vessels of high-tensile steel. The new electrode is designated "Fleetweld No. 9 HT" and has been developed for welding the new higher tensile steels of 70,000-80,000 psi. tensile strength which are gradually replacing steels of 55,000 psi. in pressure vessel construction.

In developing the new electrode, Lincoln engineers recognized the need for a rod suitable for welding deep-groove joints and capable of producing welds having higher tensile strength.

"Fleetweld No. 9 HT," produces weld metal which possesses extra strength and creep resistance at elevated temperatures. In addition to producing weld metal, with proper physical properties for high pressure work, the electrode operates satisfactorily with alternating current or direct current. Since it possesses good a-c. characteristics, it can be used with good results on either plus or minus d-c. polarity. The new electrode is for welding in a down, or flat, position only.

Physical properties of "Fleetweld No. 9 HT" weld deposits, stress relieved at 1200 deg., are approximately as follows:

Tensile strength—70,000-76,000 psi.
Yield point—58,000-63,000 psi.
Ductility, elongation in 2 in.—27-32%.

Special features of the electrode include low spatter loss, high deposition rate, easily removable slag formation, well-shaped beads and weld deposits having minimum porosity. "Fleetweld No. 9 HT" is made in 18-in. lengths in two sizes 3/16-in. and ¼-in.

» «

New Electrode for Welding Chrome Steel

★ The Harnischfeger Corp., Milwaukee, Wis., announces to the welding industry—Smootharc "Harchrome"—a new electrode designed exclusively for welding 4-6% chrome steel. Smootharc "Harchrome" deposits weld metal which has the same properties as the parent metal—a characteristic most important in this field of arc welding. The base metal used in this electrode contains from 4-6% chromium and .50% molybdenum, the purpose of which is to heighten its resistance to certain types of corrosion and oxidation, as well as to increase its creep strength and resistance to impact. Manufactured in sizes from ⅛ in. to 5/32 in. in diameter, and for operation with currents from 80 to 200 amp. Smootharc "Harchrome" electrodes were developed in the new welding electrode plant of Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.

» «

New Smootharc Welding Electrode for Alloy Steel Work

★ The Harnischfeger Corp. of Milwaukee, Wis., announces Smootharc "Har-Ten," a new welding electrode designed for welding Man-Ten, Cor-Ten, High-Steel, Republic Double Strength, Yoloy, etc. These steels, now used to a greater extent in boiler and pressure vessel construction, have much higher physical properties and greater resistance to corrosion than mild steel. Since all boilers and pressure vessels are heat-treated after welding, the weld metal must have the property of developing a higher yield point and ultimate strength by such treatment instead of a loss in physical properties as is the case when mild steel is similarly treated. Therefore, the base metal of Smootharc "Har-Ten" contains alloying elements which precipitate from solid solution at certain temperatures thereby increasing hardness and ultimate strength. Tests show that welds made with "Har-Ten" and heat-treated for one hour at 950 deg. F. increase yield point from 68,500 to 92,500 psi.; utimate tensile strength from 83,000 to 102,-250 psi.; while the percentage of elongation in 2 in. decreases from 15.5 to 14.8 under the heat-treatment.

There are two types of "Har-Ten." Type A is used for flat, vertical and overhead positions. Type B is for flat work only. Both are available in sizes from ⅛ in. to ¼ in. diameter and are manufactured in 14 in. lengths. Further information can be obtained by writing to Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.

» «

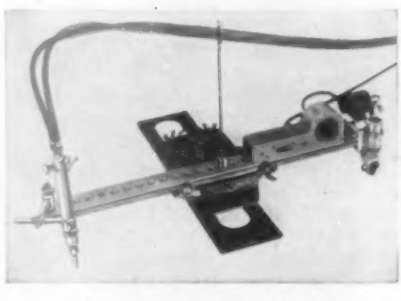
Automatic Gas-O-Graph Flame Cutting Machine

★ Compressed Industrial Gases, Inc., 221 N. LaSalle St., Chicago, announces the CIG Automatic Gas-O-Graph for the low cost cutting of steel where special or intricate shapes are required. Within a range of 30 in. in width and with no limit as to length, this new flame cutting machine will cut any shape required.

Machines to handle plates wider than 30 in. in width can be made to special order. It is stated that flame cutting by the CIG Automatic Gas-O-Graph is so accurate that machining is seldom required. Cutting can be handled from a tracing, template or pattern, and where desired more than one torch can be operated to speed up production.

The CIG Automatic Gas-O-Graph weighs approximately 100 lbs. It is claimed that the machine can be assembled by one man, ready for operation in five minutes. Because of the portable feature of the Gas-O-Graph the machine can be taken to the work, thereby eliminating the necessity of moving heavy steel plates. Where desired, however, the Automatic Gas-O-Graph can be set up as a stationary unit by purchasing a special table available for this purpose.

It is stated that the Automatic Gas-O-Graph sells for considerably less money than competitive machines within the same cutting range. It is further claimed that, combined with low initial cost, the user enjoys exceptionally low operating costs and negligible maintenance and replacement expense.



CIG Automatic Gas-O-Graph.

News of the Industry

A.S.M.E. Nominates 1939 Officers

Nominations for officers of The American Society of Mechanical Engineers for 1939 were announced at a recent meeting of the Nominating Committee held at St. Louis, Mo., during the semi-annual meeting. Election will be held by letter ballot of the entire membership closing on September 27, 1938. The nominees as presented by the regular nominating committee of the society are:

President

Alexander G. Christie, Professor of Mechanical Engineering, Johns Hopkins University, Baltimore, Md.

Vice-Presidents (4)

Henry H. Snelling, Senior Member, Snelling & Hendricks, Washington, D. C.

W. Lyle Dudley, Vice-President in Charge of Design & Sales, Western Blower Co., Seattle, Wash.

James W. Parker, Vice-President and Chief Engineer, Detroit Edison Co., Detroit, Mich.

Alfred Iddles, Application Engineer, Babcock & Wilcox Co., New York, N. Y.

Managers (3)

Clarke Freeman, Vice-President in Charge Fire Prevention Engrg. & Underwriting, Mfrs. Mutual Fire Ins. Co., Providence, R. I.

Willis R. Woolrich, Dean of Engineering, University of Texas, Austin, Tex.

William H. Winterrowd, Vice-Chairman, Franklin Railway Supply Co., Chicago, Ill.

» «

New Streamliners Go in Service with All-Welded Steel Cars

High-tensile steels for the construction of railroad passenger welded equipment reached a new level on American railroads when the new streamliners of the New York Central and Pennsylvania railroads began their inaugural runs simultaneously from east and west terminals June 15. Streamlining with high-tensile steels is in keeping with the deluxe appointments which these trains offer to the public without any increase in the established fare. Greater strength and greater resistance to corrosion plus welded fabrication permit Cor-Ten steel to give substantial savings in weight through the use of thinner sections in car bodies.

As a result of a reduction of approximately one-third in weight of the complete train, and a more efficient locomotive plus streamlining, the New York Central expects its new Century to reduce fuel consumption by 10 to 15 per cent between Harmon, N. Y., and Chicago. Approximately 47 tons of coal were regularly burned on this run. Operating economies of the new streamliner are expected to show savings of from 5 to 10 tons of coal.

The new Broadway Limited and the Twentieth Century will be the first all-room trains in America, with Pullmans including various groups of roomettes, bedrooms, compartments, drawing rooms, and master bedrooms. The new all-welded cars for these trains were built largely of Cor-Ten by Pullman-Standard Car Mfg. Co., although two Pennsylvania streamlined diners of stainless steel were constructed by Edward G. Budd Mfg. Co.

» «

Electrical Engineers Elect Officers

Dr. John C. Parker, vice-president, Consolidated Edison Co. of New York City was elected president of the American Institute of Electrical Engineers for the year beginning August 1, 1938, at the annual meeting of the Institute held in Washington, D. C., during the annual summer convention of the Institute. The other officers elected were: Vice-Presidents Chester L. Dawes, Cambridge, Mass.; F. Malcolm Farmer, New York City; A. H. Lovell, Ann Arbor, Mich.; F. C. Bolton, College Station, Tex.; Lester R. Gamble, Spokane, Wash. Directors Leland R. Maples, Chicago, Ill.; Harold S. Osborne, New York City; D. C. Prince, Philadelphia, Pa. National Treasurer W. I. Slichter, New York City (re-elected).

The annual report of the board of directors, presented at the meeting, showed a total membership on April 30, 1938, of 16,078. In addition to three national conventions and two district meetings, 1,958 meetings were held during the year by the local organizations of the Institute in the principal cities and educational institutions in the United States, Canada, and Mexico.

» «

The Chicago, Burlington and Quincy railroad's Zephyr fleet achieved the mark of five million miles of regular passenger service on June 21. Built by the Edward G. Budd Mfg. Co. of Philadelphia, Pa., the fleet has compiled an enviable record. The "availability for service" figure is approximately 95 per cent, in spite of the extremely fast schedules.

Since their inception, the Burlington Zephyrs have made news by virtue of unusual performance. On May 26, 1934, the Pioneer Zephyr broke all existing records for long distance non-stop railroad travel by running from Denver to Chicago in 13 hrs. and 5 min. On October 23, 1936, one of the big Denver Zephyrs made the same run in 12 hrs. and 12 min.—a record of 83.3 m.p.h., which still stands.

» «

Motion Picture on Plowshare Hard-Facing

The use of hard-facing as an economical method of increasing the life of plowshares is depicted in the motion picture, "Haynes Stelliting the Plowshare," which is available for showing from the offices of either The Linde Air Products Co. or Haynes Stellite Co. This film will be of interest to farmers, welding shop owners, ironsmiths, and all others concerned with the maintenance of agricultural implements. Its thorough treatment of the many advantages and economies of hard-facing should make it a valuable aid in building up sales.

A clear, step-by-step presentation of every detail of cleaning, grinding, hard-facing, and subsequent sharpening operations is given. In addition, several interesting views show the use of a copper nose plate for quickly forming the hard-facing alloy on the nose of the share. Side and bottom suction, and the methods used to retain them after hard-facing, are also included in this instructive film.

» «

Industrial Research Institute Is Organized

H. W. Graham, general metallurgist, Jones & Laughlin Steel Corp., Pittsburgh, Pa., has been named vice-chairman of the executive committee of the newly formed Industrial Research Institute, a national organization composed of scientific research executives of middle-sized and small-sized industries. The Institute has been established as the result of a factual survey which indicated a need for an organization of industrial research executives so that they might have an opportunity to discuss common problems relating to laboratory organization and administration, and other technical matters bearing on industrial research.

Maurice Holland, director of the National Research Council's Division of Engineering and Industrial Research, will act as executive officer of the Institute and the technical resources of the Division will be made available to the Institute during the organization stage.

» «

W. V. Emery Talks on Surface Hardening—One of the highlights of the welding clinic recently held at the La Crosse Vocational School in La Crosse, Wis., was W. V. Emery's discussion on "Surface Hardening of Welded Units." Mr. Emery, welding foreman of the Harnischfeger Corp., Milwaukee, Wis., presented an informative and interesting resume of this subject.

Personals

Robert H. Heyer, junior metallurgist, research laboratories, The American Rolling Mill Co., has been chosen as winner of the Charles B. Dudley Medal for 1938. This medal, which commemorates the name of the first president of the American Society for Testing Materials is awarded to the author or authors of the paper presented at the preceding annual meeting which is of outstanding merit and constitutes an original contribution on research in engineering materials. The medal was awarded to Mr. Heyer on Wednesday, June 29, during the forty-first A.S.T.M. annual meeting in Atlantic City. The paper which won for Mr. Heyer the Dudley Medal is entitled, "Analysis of the Brinell Hardness Test," and is based

Low Fuming Welding Rods

ANACONDA 997 (Low Fuming) Welding Rods—high strength, tough weld metal with low fuming characteristics—has been added to the extensive line of Anaconda copper alloy welding rods. It is widely used for the general oxy-acetylene repair-welding of cast and malleable iron, steel and copper . . . It is particularly valuable where repairs must be made quickly and easily on machinery parts, automobile engine blocks and similar equipment. Anaconda 997 Welding Rod is manufactured under United States Patents Re 17,631 and 1,525,058. Available from supply houses handling Tobin Bronze and other Anaconda Welding Rods. 39264

THE AMERICAN BRASS COMPANY

General Offices: WATERBURY, CONNECTICUT • *Offices and Agencies in Principal Cities*

In Canada: AMERICAN BRASS LTD., New Toronto, Ontario

ANACONDA
from mine to consumer

Anaconda Welding Rods

on a thesis which he presented to the faculty of Purdue University in partial fulfillment of the requirements for the degree of Doctor of Philosophy, June, 1938.

» «

WALTER K. DOW was elected vice-president of The Alexander Milburn Co., Baltimore, Md., on May 23, 1938. Before becoming associated with Milburn, Mr. Dow was identified with the DeVilbiss Co. at Toledo, Ohio, for ten years in a manufacturing and supervisory capacity. Mr. Dow has been plant superintendent of the Milburn Co. for the past year in charge of the development and production of paint spray equipment, welding and cutting apparatus, portable lights, etc.

» «

A. E. ASHCRAFT, Fairbanks, Morse & Co., vice-president in charge of manufacturing, has announced the appointment of A. C. HOWARD to the position of general manager of the company's Beloit, Wis., plant. This position formerly was held by Mr. Ashcraft in addition to his executive control of all Fairbanks-Morse factories in the United States and Canada. Mr. Howard has been assistant general manager of the Beloit plant for six years. His association with the company began 22 years ago when he was employed as an inspector at the Canadian Fairbanks-Morse Co., Ltd., Toronto.

» «

RAYMOND M. DENNIS has been appointed general manager of the flanging department at Lukens Steel Co., Coatesville, Pa., in charge of estimating, sales and production. Mr. Dennis was born in Westgrove, Pa., in March, 1888, and received his education at the University of Pennsylvania, graduating in 1910 with the degree of civil engineer. Mr. Dennis joined the Lukens organization in April, 1925, as press-foreman in the flanging department. In 1928, Mr. Dennis was appointed superintendent of the flanging department in which capacity he served until his recent appointment as general manager of the flanging department.

Raymond M. Dennis.

» «

H. B. RICE, formerly vice-president of the Metalspray Co. Inc., Los Angeles, Calif., has joined the engineering department of the Metallizing Co. of America, Inc., with general offices in Los Angeles. Mr. Rice will continue his work in process development fields. His efforts in development and improvement have aided materially in the rapid increase in use of the metal spraying process during the past eight years.

WILLSON

Headquarters FOR WELDING PROTECTION

GOGGLES HELMETS HANDSHIELDS

Style RW 50, herewith illustrated employs 50mm. Willson-Weld Lenses and 50mm. Clear Cover Lenses

The Complete WILLSON LINE of Welding Protective Equipment is fully described in our new Catalog.

WRITE FOR CATALOG

DOUBLE WILLSON PRODUCTS INCORPORATED READING PENNSYLVANIA

INDUSTRIAL SAFETY EQUIPMENT ASSOCIATION

GOGGLES RESPIRATORS HELMETS

Future Meetings

August 9-12, 1938

American Institute of Electrical Engineers, 33 W. 39th St., New York City.
Pacific Coast convention at Portland, Ore.

September 27-30, 1938

Association of Iron and Steel Engineers, Empire Building, Pittsburgh, Pa.
Annual convention and Iron and Steel Exposition in the Cleveland Public Auditorium, Cleveland, Ohio.

October 5-7, 1938

American Society of Mechanical Engineers, 29 W. 39th St., New York City.
Fall meeting at Providence, R. I.

October 10-14, 1938

American Institute of Steel Construction, Inc., 200 Madison Ave., New York City.
Annual meeting at French Lick Springs, Ind.

October 17-21, 1938

National Metals Congress and Exposition, held in conjunction with American Welding Society, American Society for Metals, American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, and The Wire Association. American Welding Society headuartqers will be at the Book-Cadillac Hotel, Detroit, Mich.

October 24-27, 1938

American Mining Congress (Western Division)—Fifth Annual Metal Mining Convention and Exposition at the Ambassador Hotel, Los Angeles, Calif.

November 14-18, 1938

American Petroleum Institute, 50 W. 50th St., New York City.
Nineteenth annual meeting at the Stevens Hotel, Chicago, Ill.

November 28-30, 1938

American Institute of Electrical Engineers, 33 W. 39th St., New York City.
Southern District meeting at Miami, Fla.

December 5-9, 1938

American Society of Mechanical Engineers, 29 W. 39th St., New York City.
Annual meeting in New York City.

December 5-10, 1938

National Exposition of Power and Mechanical Engineering will be held at Grand Central Palace, New York City.

Trade News

WILLSON PRODUCTS, INC., ENLARGES PLANT FACILITIES

WILLSON PRODUCTS, INC., Reading, Pa., manufacturers of goggles, respirators and welding protective devices, have just enlarged their factory at a cost of more than a half-million dollars in order to take care of mounting production demands. The com-

pany, which was established in 1870 by the late T. A. Willson, is said to have been one of the first organizations to specialize in the manufacture of protective eye, nose, throat and lung equipment for industrial workers. This well lighted and well ventilated building has in excess of 110,000 sq. ft. of floor space.

Willson Products, Inc., manufactures more than 350 types of goggles, and a wide variety of welding helmets and handshields all employing Super-Tough glass; also tinted ophthalmic blanks for prescription work, and a wide variety of sun glasses. In recent years, the company has given considerable attention to the silicosis hazard and a large industrial hygiene laboratory is now maintained at Reading in charge of Dr. A. D. Brandt. This laboratory devotes its full time to developing and improving respiratory protective devices for use in all branches of industry where dust hazards exist.

Following is a list of the officers and executives of this company: Dr. Frederick Willson, president and chairman of the board of directors; Thomas A. Willson, vice president and general manager; Harold M. Hafer, secretary-treasurer; John F. Clark, assistant secretary; F. E. Stump, assistant treasurer; M. C. Rider, purchasing agent; Frank E. Camp, sun glass sales manager and Bernard Leavy, advertising manager.

» «

20 Years in Welding Business

Omaha Welding Co., 1501 Jackson St., Omaha, Nebr., celebrated its 20th anniversary on July 18. L. O. Schneiderwind, known to the trade as "Heinie" is president of this 20-year old concern. Omaha Welding Co. claims to be the oldest and largest job welding shop in Omaha, Nebr. A further claim to distinction is the fact that

"Heinie" Schneiderwind.

this company has handled the same line of oxy-acetylene welding equipment for a longer period of time than has any other jobber in Omaha.

"Heinie" Schneiderwind started this business on July 18, 1918, by renting a small space formerly used for an automobile washing rack. A year later he expanded his shop until it was about 22 ft. square, doing a strictly job welding business. In 1921 Mr. Schneiderwind took on the distribution of Smith Welding Equipment and began selling welding equipment and supplies in addition to conducting his job welding business. A salesman was hired and active representation was started in the territory immediately adjacent to Omaha. From this beginning his jobbing business steadily expanded until today Mr. Schneiderwind employs five salesmen who travel the State of Nebraska and parts of the adjoining states.

Each year the Omaha Welding Co. conducts a welding conference for the benefit of its customers. These conferences are designed to do an educational job. Registration at these conferences has increased each year, proving that Mr. Schneiderwind's customers have found them to be educational. At the most recent welding conference held March 2-4, attendance reached the figure of 425, not including any manufacturers' salesmen or distributors. The company recently opened a welding school which is conducted under the supervision of J. R. Reid.

» «

Hobart Arc Welder Sales & Service, Detroit, Mich., has a new building under construction at 5257 Trumbull Ave., to house its expanding business. The building is especially designed for the company's type of work. It affords 3,000 sq. ft. of space and is of cement block and brick construction with modernistic front. A special room will house welding machines for demonstration purposes. Estimated cost of the building is $13,500.

The branch is in charge of Roy Smith who has been Michigan representative of

Okocord
EXTRA FLEXIBLE
WELDING CABLE

● **The ideal welding cable must be flexible, must stand abuse and be perfectly insulated.**

Okocord Welding Cable embodies these three attributes. It is extremely flexible, because the conductor is made of a great many fine copper wires. It withstands mechanical abuse because it is made made with a jacket of tough, tire-tread type of 60% rubber. It has perfect insulation because it is insulated by The Okonite Company —an acknowledged leader in the insulation field since 1878.

For long trouble-free service, use Okocord Welding Cable.

1938 Marks Our 60th Year of Service
THE OKONITE COMPANY
Founded 1878
EXECUTIVE OFFICE:
HAZARD INSULATED WIRE WORKS DIVISION
PASSAIC, NEW JERSEY
THE OKONITE-CALLENDER CABLE CO., INC.
New York Boston Seattle Buffalo Chicago Dallas Detroit Atlanta
Philadelphia Los Angeles Pittsburgh St. Louis Washington San Francisco
OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

the Hobart Arc Welder Sales & Service for the past 14 years. Assisting him are Earl W. Bagg, C. A. Overturs, Donald L. Sanders, H. L. McLurg and Edward Mercier.

» «

Goodweld Equipment Co., formerly of 3242 Broadway, New York City, has moved to new and larger quarters at 604 West 129th St., New York City. Goodweld Equipment Co. are New York distributors for Page welding wire and Harris Calorific Co.'s gas welding equipment.

» «

J. D. Adams Co. announces that its Chicago office and warehouse has been moved to 4557 W. Diversey Ave. In these new and larger quarters, the company will carry a larger stock of equipment and supplies for servicing the Chicago area. Quicker service will also be rendered to nearby cities by shipping from Chicago rather than from the J. D. Adams plant in Indianapolis.

» «

The Allied Steel Products Corp., 1407 N. Peoria St., Tulsa, Okla., has been appointed distributor for J. D. Adams Co., Indianapolis. Allied Steel Products Corp. will cover the territory embracing Southern Kansas, Oklahoma, Southwestern Missouri, Northwestern Arkansas and the Texas Panhandle. Complete stock of welding electrodes and welding machines will be carried at Tulsa, Okla., for quick delivery. It is stated that this distributor intends to offer 24-hour service to its customers.

» «

Osage Metal Co., Inc., manufacturers and distributors of hard-facing metals has moved into a new plant and office building at 7413 So. Blackwelder St., Oklahoma City, Okla. The new building provides more than double the floor space of the old location at 1900 N. Eastern Ave.

Construction

Welding Helps Keep River Flowing Backwards

Usually, the Chicago River is a well-behaved stream flowing tranquilly from Lake Michigan in the route laid out for it by city engineers who defied the laws of gravity and made the river flow backwards to the Mississippi. When the city of Chicago is subjected to heavy rains, however, and the storm sewers overflow, the river sometimes throws off all restraint and returns to its natural course, flowing back into the lake and carrying sewage with it. To offset this situation, a new breakwater is being built out into Lake Michigan so that the lock, already constructed at the juncture of river and lake, can prevent water from backing up into the lake. To reinforce this breakwater, built of steel piling by the Ketler-Elliott Co., steel railroad rails were welded to the piling along the entire length of the breakwater. General Electric Type W22E electrodes were usd.

» «

Marin Chemical Co., Ltd. of South Francisco, Calif., has awarded a contract to the Western Pipe & Steel Co. for construction of a number of welded steel tanks.

» «

Richfield Oil Corp. of California will soon construct a $100,000 oil re-run plant to be located at its Watson, Calif., refinery. Welding will play an important part in the construction of this plant.

» «

Blue Channel Mining Co. of Angel's Camp, Calif., plans the erection of a welded gravel-treatment plant, including such equipment as a trommel screen, riffles, jigs and amalgamator.

The Texas Co. and Socony-Vacuum Oil Co., jointly, have started construction of a 260-mile welded oil pipeline in the Barco Concession in Colombia, South America. It is estimated that this line will cost about 11 million dollars and is scheduled for completion early in 1939.

» «

Barnsdall Oil Co. has recently completed a new oil refinery near Odessa, Texas. This new plant included laying of welded pipelines, connecting the refinery with 110 wells in the Ector County field. It is stated that 200 additional wells will be connected with the pipeline system as the wells are completed.

» «

Humble Oil & Refining Co. of Houston, Texas, is laying a welded 8-in. oil pipeline under six feet of water. This line will extend from Mesquite Point in Western Chambers County to an oil well in the Cedar Point submerged area. The pipe is being welded in 750-ft. sections on the shore and transported on barges out to location. The 750-ft. sections are then welded together and lowered to the bottom of the water, approximately six feet.

» «

A welded eight-inch oil pipe line will be constructed in the near future by the Texas-New Mexico Pipe Line Co. The line will extend from the Vacuum oil field in eastern New Mexico, to the company's trunk line station some 18 miles southwest.

Current Reviews

Handbook of Industrial Safety Standards—Publication of a revised and expanded edition of this handbook is announced by the National Conservation Bureau of the Association of Casualty and Surety Executives. This handbook is a guide for safeguarding working conditions in industrial plants. It is widely used by industrial managers responsible for accident control and by insurance company engineers in providing service for industrial clients.

The new edition contains 192 pages and has 32 chapters treating the principal phases of safe industrial operations. There are more than 70 illustrations. A new feature is an amplified seven page cross-index which enables the reader to locate quickly desired information. The material in the handbook is based on standard codes for the subjects treated in all cases where such codes exist. It was written under the direction of committees of safety engineers who have had long exuerience in industrial accident control.

The handbook is being sold at $.39 per copy. Special discounts are available to member companies of the National Conservation Bureau.

» «

"Your Place in Life" is the title of a small book designed to help young men select a suitable vocation for making a living. A total of 22 major vocations are described. It is stated that the editorial material was prepared especially for this book by men who are qualified to discuss each of the

The Improved "Round File" Gas Lighter

Immediate Ignition Assured

The Hood of the Improved "Round File" Gas Lighter is so designed as to form a "pocket" for the gas—an exclusive feature—which assures IMMEDIATE ignition. Get acquainted with the many other superior, exclusive features of Improved "Round File." ***Circulars and prices on request.***

SAFETY GAS LIGHTER CO. (Est. 1901) **LYNN, MASS.**

vocations. The chapter on welding was prepared by L. C. MONROE of *The Welding Engineer*. The book will be mailed anywhere in the United States for 25 cents by writing to the publishers, "The Trail-Blazers," 119 West Park Ave., Champaign, Ill.

Recent Patents

APPARATUS FOR TREATING METAL

2,110,781. ROBERT L. WAGNER, Astoria, N. Y., assigned to Union Carbide and Carbon Corp., N. Y. Filed Nov. 29, 1933. This invention relates to the prevention of changes in high-carbon and alloy steels due to the effects of high temperature and oxidation from oxy-acetylene and electric arc metal treating. Ordinarily the rate of cooling which follows the application of heat is so rapid as to render the treated metal brittle. The patentee overcomes this by following the initial torch with a second torch which controls the rate of cooling of the treated metal. The two torches are mounted on a carrier, the distance between the torches being controlled in accordance with the rate of cooling desired.

» «

ALLOY LINERS FOR PRESSURE VESSEL

2,111,791. LOUIS J. LARSON, Milwaukee, Wis., assigned to A. O. Smith Corp., Milwaukee, Wis. Filed Mar. 26, 1936. A method of welding alloy liners in vessels such as cracking stills, paper digesters, and similar processing devices. A shallow groove is provided between the edges of the alloy liner material with the bottom edges meeting. This groove is filled with alloy weld material with an electric arc. By this procedure a weld is obtained in which the filler material is not diluted substantially with the base metal beneath the liner. The joint so produced is resistant to cracking.

» «

HARD-FACING ROD

2,118,296. ANTHONY G. DE GOLYER, New York, N. Y., assigned to Vulcan Alloy Corp. of Delaware. Filed July 6, 1936. Relates to a weld rod for refacing or reclaiming carbon steels and alloy steels. The composition contains 3% to 10% tungsten, 2% to 5% chromium, 0.15% boron, 0.30% to .90% carbon, .20% to 1.00% manganese, .20% to 1.00% silicon, and the remainder iron. The material has a hardness over 600 Brinell, and is particularly adapted for use in elements subject to shock and impact.

» «

WELDING SPHERICAL VESSELS

2,118,388. FREDERICK K. ZERBE, Waukesha, Wis., assigned to A. O. Smith Corp., Milwaukee, Wis. Filed June 29, 1936. Provides a method of welding spherical vessels and X-raying the welded joints to assure a high quality weld. The main body of the vessel is made of sectors welded edge to edge. Top and bottom sections are left out during this step. After completion of the main body, the bottom head is welded in place. All of the seam are then X-rayed by means of suitable equipment lowered into the vessel from the open top. The top is subsequently secured to the vessel, a small opening being provided in the top head for valve connections. The top seam is then X-rayed by lowering the X-ray device through the opening left for the valve head. Finally the valve closure mechanism is secured.

» «

HIGH SPEED WELDING ROD

2,118,679. ARTHUR R. LYTLE, Niagara Falls, N. Y., assigned to Oxweld Acetylene Co., of West Virginia. Filed July 16, 1936. A steel welding rod producing sound, strong welds in high speed continuous fusion deposition welding operations without manipulative puddling. The rod contains silicon which promotes a desirable sluggishness of the molten weld metal, and is free from sulfur. The sulfur is avoided since the silicon increases the effect of the sulfur in producing porosity.

» «

WELDING FLUX

2,118,680. ARTHUR R. LYTLE, Niagara Falls, N. Y., assigned to Oxweld Acetylene Co., of West Virginia. Filed July 16, 1936. A welding flux which contains boron oxide, zinc oxide, and an alkali metal halide compound in a small proportion. This flux is especially suited as a coating or core for welding rods of lead-containing non-ferrous metal.

STRONGER WELDS

With a MARQUETTE A.C. ARC WELDER

BECAUSE 60 cycle current reverses its direction constantly and rapidly the Marquette Welder puddles the molten weld and parent metals thus floating the impurities to the top where they form a slag. The resultant weld is non-porous and exceptionally strong. This is but one of the reasons you can repair or fabricate metals better with a Marquette. Your Jobber Salesman will be glad to give you full details.

- Three models at three prices . . . a size and price to fit your needs . . . $155, $195 and $225.
- Oversize transformer for reserve power and steady even arc at all 15 heat stages.
- A tap for every heat, a heat stage for every job . . . no dials, no combinations, no confusion.
- Ample ventilation through bottom screen and louvered top.
- Every model fully equipped . . . nothing extra to buy.

Marquette A. C. Arc Welders are listed by Underwriters' Laboratories, Inc., and carry their Reexamination Service Marker.

Ask Your Jobber Salesman for Full Details or Write Direct to

MARQUETTE MFG. CO., INC.
MINNEAPOLIS, MINNESOTA

Trade Literature

"How to Fit Eye-Protection Goggles to Workers for Greatest Comfort and Safety" is the self-explanatory title of a new pamphlet just issued by American Optical Co. of Southbridge, Mass. The pamphlet is divided into two parts. One section is devoted to instructions on the fitting of eye-cup goggles; the other to the spectacle type of goggles. These sections can be posted on bulletin boards for ready reference as they are made out of heavy, durable paper. Maximum protection and comfort will be afforded workers if the simple instructions listed in the pamphlet are carried out faithfully.

A copy will be sent to any industrial concern upon request.

» «

Smootharc Welding Electrodes — The Harnischfeger Corp. of Milwaukee, Wis., announces Bulletin R-5 which gives complete and specialized information and data on each of the many Smootharc welding electrodes. A modern manual of welding electrode information, this bulletin includes spark tests, procedure sheets and many other informative suggestions to make it a valuable reference book for all welding users and operators. Its information is applicable whether the job is welding Man-Ten steel, chrome steel, stainless steel, manganese steel, nickel steel, etc.—and in overhead, downhand or poor fit positions. Copies may be obtained by writing to Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.

» «

Flame Hardening—An illustrated booklet, "Flame Hardening," has just been published, describing the process whereby the surface of iron or steel is locally heated by means of an oxy-acetylene flame and then hardened by rapidly quenching in water, leaving the core of the metal tough and ductile. The process as described is highly flexible, and is readily adaptable to a wide variety of sizes and shapes of parts. The booklet discusses the advantages of the process, and describes the necessary equipment and the various flame hardening methods employed—stationary, progressive, spinning and combination. A table is included listing a number of steels particularly suited for flame hardening. Copies can be obtained without charge from The Linde Air Products Co., 205 East 42nd St., New York City.

» «

The American Manganese Steel Division of the American Brake Shoe & Foundry Company, has issued Bulletin 516 covering hard-surfacing of plow shares with Amsco No. 459 hard surfacing welding rod. A unique method of holding the share for welding is aptly illustrated, and proper welding methods are discussed.

» «

Airco-DB No. 10 Radiagraph is the subject of a new booklet which has just been published by the Air Reduction Sales Co., 60 East 42nd St., New York City. It explains in detail the many new features and diversified cutting operations that can be done with this light weight gas cutting machine. Halftone illustrations throughout and full information on the mechanical feature tell a thorough story of Airco's newest low priced motor-driven gas cutting machine. Copies of the bulletin may be obtained by writing to any Airco office.

» «

"Air Conditioning for Lower Welding Costs" is the title of a four-page folder just issued by Lincoln Electric Co., Cleveland, Ohio. The folder describes and points out the advantages of the new "Linconditioner" in a welding shop.

General Electric Co., Schenectady, N. Y., has issued Bulletin GEA-2965, describing the new Type W-3 thinly coated electrode for high speed arc welding. This electrode is recommended for automatic applications but is also suitable for manual welding. The electrode is available in three types, differing in carbon content, from minimum of .06 to a maximum of .18 per cent.

» «

General Electric Co., Schenectady, N. Y., has issued Bulletin GEA-2966, describing its Type A sheath-coated electrode for cast-iron welding. This electrode is designed especially for repairing cast-iron parts and it is stated that it can be used successfully in the vertical, as well as the horizontal and flat welding positions.

» «

"Thyratron Resistance-Welder Controls" is the subject of an eight page bulletin, GEA-2791A, just issued by General Electric Co., Schenectady, N. Y. This bulletin features the application of G-E Thyratron Control for resistance welders. These controls provide accurate timing of welding current, also govern the magnitude of the current. Included is a description of special controls for interrupted spot welding.

» «

"Roebling Welding Wire" is the title of a 40-page booklet just issued by John A. Roebling's Sons Co., Trenton, N. J. The complete line of Roebling bare and covered electrodes and Roebling gas welding wire are described, including technical information on chemical analyses and proper polarity. Booklet also contains information on Roebling welding cables, pointing out the factors which should be considered in selecting such cable. Flexibility, resistance to abrasion and heat, and dielectric strength are the important factors in selection of welding cable. Roebling makes several types to meet the needs of any particular welding job.

» «

Osage Metal Co., 1900 N. Eastern Ave., Oklahoma City, Okla., has published a 24-page booklet describing Osage hard-facing electrodes and welding rods. Osage is described as a "Super Diamond Substitute." It is a cast tungsten carbide product designed for hard-setting oil well drilling tools. It is claimed that it possesses a hardness greater than sapphire, and that its strength is greater than that of either sapphire or diamond. The booklet describes methods of applying Osage metal to oil well drilling tools.

Ryerson a dependable source for Welding Rod

● Ryerson Engineers have developed a series of rods that are outstanding for Quality production. More than twenty types, including both electric and gas rods, are carried in stock. Whether you need a shielded arc type for production work or a stainless steel rod you can be sure of immediate shipment... *Write for Bulletin which gives complete data.*

ELECTRODES

Ryerson Shielded Arc Type No. 215
Ryerson Shielded Arc Type No. 216
Ryerson Shielded Arc Type No. 217
Ryerson Green Processed No. 18
Ryerson Green Processed No. 6 Bare Mild Steel
Ryerson Brown Processed White Flux Coated High Carbon White Flux Coated
Ryerson Blue Flux Coated
Ryerson Copper Coated No. 206
Ryerson Copper Coated No. 210
Ryerson Cast Iron
Ryerson 3½% Nickel Steel Flux Coated
Ryerson High Manganese Steel Hard Surfacing
Allegheny Stainless Flux Coated
Allegheny Stainless No. 44
Tobin Bronze
Allegheny Stainless Bare Hard Filler

GAS RODS

Ryerson 3½% Nickel Steel
Ryerson High Carbon Bare No. 2110

JOSEPH T. RYERSON & SON, Inc., Chicago, Milwaukee, St. Louis, Detroit, Cleveland, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City

Obituary

George E. Emmons, 80, formerly manager of the Schenectady Works of the General Electric Co. and later vice president in charge of manufacturing for the company, died in Pasadena, Calif., July 1. Burial was at Pasadena on July 6. Mr. Emmons devoted more than a quarter century directing the development of one of the world's biggest electrical plants as general manager of the Schenectady works, General Electric Co.